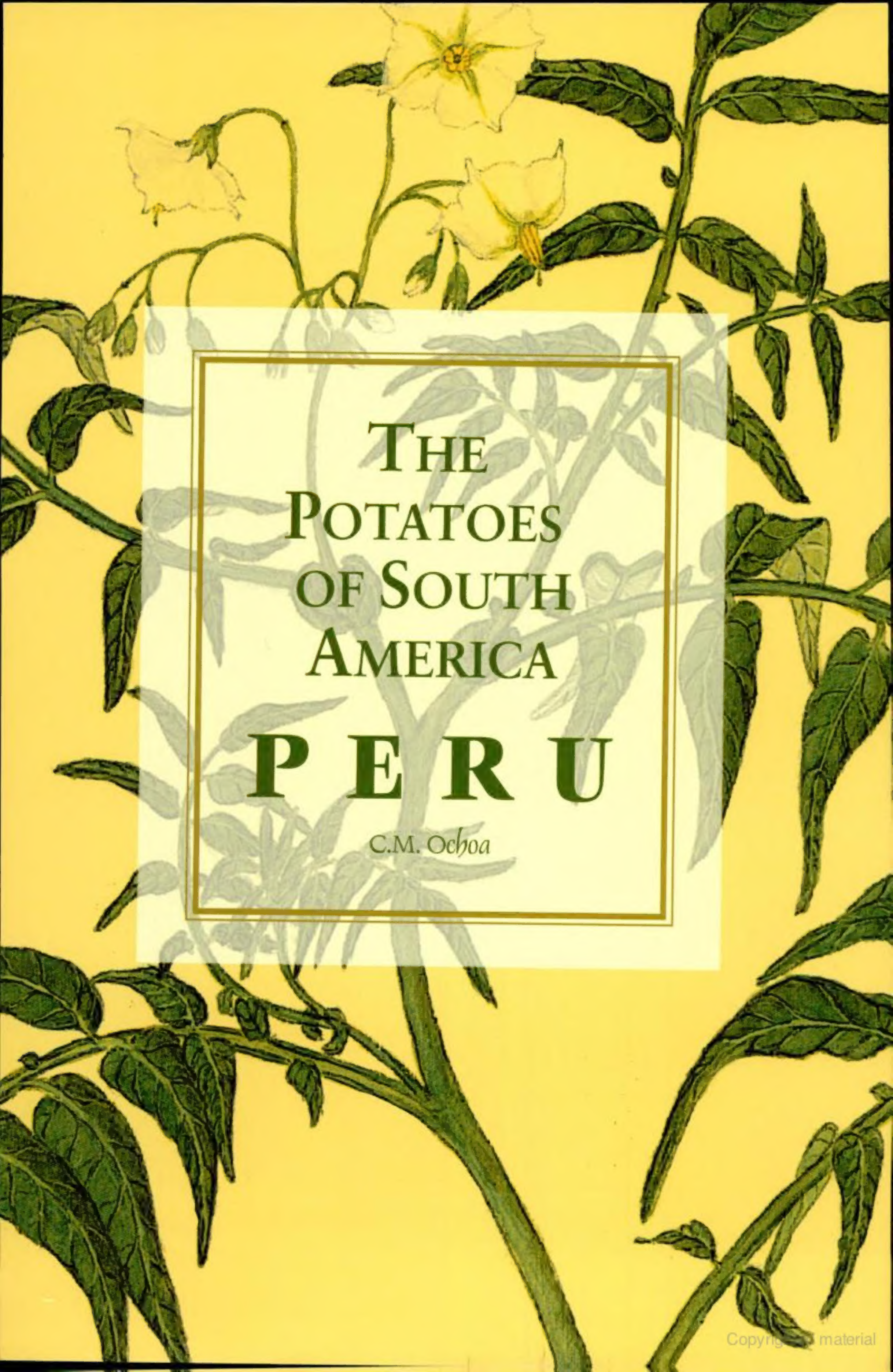

THE POTATOES OF SOUTH AMERICA

PERU

C.M. Ochoa

About the Author

Born in Cuzco, Peru, Carlos Ochoa is a native son of the South American Andes, the mountainous cradle of origin of the potato plant. For more than 40 years, as a youth and as a professional plant breeder and taxonomist, Ochoa has combed the rugged mountainsides to describe and document the characteristics of the widely diverse wild potatoes and their native habitats. In these explorations, and others throughout the world, he has discovered over 70 new wild potato species and rediscovered at least 15 species. In addition, he has bred highly productive new commercial potato varieties for his Peruvian homeland.

For more than 20 years he was professor at the National Agrarian University in Lima and he has collaborated with the Max Planck Institute in Germany, the Museum of Natural History in Paris, the British Museum and Kew Gardens in England, the Institute of Plant Breeding in Wâgeningen, the Netherlands, and the National Museum of Natural History of the Smithsonian Institute in Washington, D.C. He is now Senior Scientist Emeritus at the International Potato Center in Lima, Peru.

Ochoa is the author of numerous published works, including the Taxonomy of Wild Tuber-bearing Potatoes of Peru, the Potatoes of Bolivia, which is the first in a series of monographs on the potato species of South America, and a wide range of scientific journal articles.

THE POTATOES OF SOUTH AMERICA: PERU

(PART I: THE WILD SPECIES)

by C. M. Ochoa

translated by

Donald Ugent

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The Potatoes of South America: Peru
Part 1: The Wild Species
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Translated by Donald Ugent

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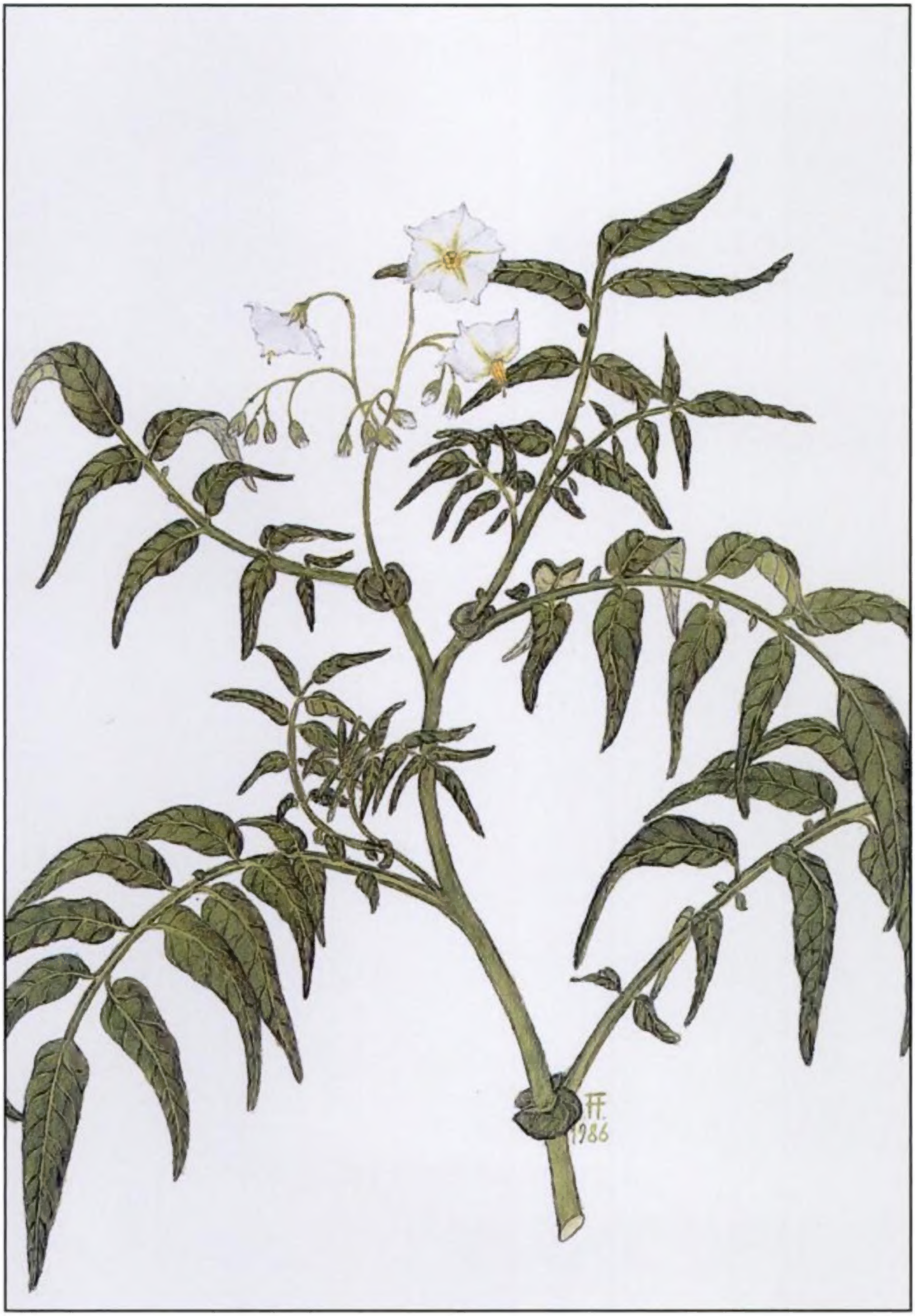
To

Fortunato L. Herrera and César Vargas Calderón

for their pioneering studies on potato in Peru
and their scientific contributions
to systematic and
economic botany



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100. Leaves of *Solanum* × *blanco-galdosii* (*Ochoa 2714,* holotype).
101. Floral dissection of *Solanum* × *blanco-galdosii* (*Ochoa 13009*).
102. *Solanum peloquinianum* (*Ochoa 13222*, holotype).
103. Floral dissection of *Solanum peloquinianum* (*Ochoa 13002*).
104. Berries of *Solanum peloquinianum* (*Ochoa 13231*).
105. Tubers of *Solanum peloquinianum* (*Ochoa 13002*).
106. Habitat of *Solanum peloquinianum* in its type locality (*Ochoa 13222,* holotype).
107. View from Chuirajra of the Cañón del Munta, habitat and type locality of *Solanum peloquinianum*.

INGAEFOLIA

108. *Solanum ingaefolium* (*Ochoa 2336*).
109. Upper portion of *Solanum ingaefolium* (*Ochoa 1765*, holotype).
110. Tubers and fruits of *Solanum ingaefolium,* collected at a site known as Cumaccha (ca. 1800 m alt.), at the foot of Cerro Calvario, Piura, August 20, 1968.
111. *Solanum jalcae* (*Ochoa 1433*, holotype).
112. Floral dissection of *Solanum jalcae* (*Ochoa 1433*, holotype).

113. Tubers of *Solanum jalcae*, collected in the *jalcas* of Porcón, Cajamarca, May 1982 (*Ochoa 14782*).
114. *Solanum jalcae* in its native habitat, the *jalcas* of Porcón, Cajamarca, May 1982.
115. *Solanum jalcae* var. *pubescens* (*Ochoa and Salas 16141*).
116. *Solanum raquialatum* (*Ochoa 13947*, Plate 1).
117. *Solanum raquialatum* (*Ochoa 13947*, Plate 2).
118. Floral dissection of *Solanum raquialatum* (*Ochoa 13947*).
119. Tubers of *Solanum raquialatum* (*Ochoa 13937*).

LIGNICAULIA

120. *Solanum lignicaule (C. Vargas C. 1539*, lectotype).
121. *Solanum lignicaule* (*Ochoa 13760*).
122. Floral dissection of *Solanum lignicaule* (*Ochoa 11317*).
123. Berries of *Solanum lignicaule* (*Ochoa 11317*).
124. Carlos Ochoa examining *Solanum lignicaule* in its native habitat between Colcha and Paruro, Cusco, March 1980.
125. Habitat of *Solanum lignicaule* Vargas at a locality situated between Colcha and Paruro, Cusco.
126. Terraces at Pisac on the eastern side of the road from Pisac to Ampay, comprising the semi-natural habitats of *Solanum lignicaule*, *S. raphanifolium* and *S. marinasense*.

MEGISTACROLOBA

127. *Solanum dolichocremastrum* (*Ochoa and Cabello 16201*).
128. Type of *Solanum dolichocremastrum* (*Dombey s.n.* Peru).
129. *Solanum dolichocremastrum* (*Ochoa 2378*, type collection of "S. *huanucense*").
130. Floral dissection of *Solanum dolichocremastrum* (*Ochoa 12071*).
131. Fruits of *Solanum dolichocremastrum* (*Ochoa 12071*).
132. Tubers of *Solanum dolichocremastrum* (*Ochoa 13018*).
133. *Solanum hastiforme* (*Ochoa 2517*).
134. Fruits of *Solanum hastiforme* (*Ochoa 13290*).
135. *Solanum megistacrolobum* (*Ortega-65*).
136. *Solanum megistacrolobum* (*Ochoa and Salas 15619*).
137. Floral dissection of *Solanum megistacrolobum* (*Ochoa 14269*).
138. Habitat of *Solanum megistacrolobum* near Puno (4000 m alt.).

139. Habitat of *Solanum megistacrolobum* (*Ochoa 15619*) near Calapuya (3700 m alt.), Puno.

140. *Solanum megistacrolobum* var. *toralapanum* (*Ochoa 13544*).

141. Tubers of *Solanum megistacrolobum* var. *toralapanum* (*Ochoa 13544*).

142. Floral dissection of *Solanum megistacrolobum* var. *toralapanum* (*Ortega 049*).

143. *Solanum megistacrolobum* f. *purpureum* (*Ochoa 14273*).

144. *Solanum raphanifolium* (*Ortega 21*).

145. *Solanum raphanifolium* (*Ugent 3552*, topotype).

146. *Solanum raphanifolium* (*Cárdenas 3506*, type collection of "*S. hawkesii*").

147. *Solanum raphanifolium* (*Ochoa 12040*, collected in the type locality of "*S. pumilum*").

148. Floral dissection of *Solanum raphanifolium* (*Ochoa 15121*, topotype).

149. Ornamentation and fruit shape of *Solanum raphanifolium* (Left, *Ochoa 12040*; Right, *Ochoa 13705*).

150. Tubers of *Solanum raphanifolium* (*Ochoa 13564*).

151. Plants of *Solanum raphanifolium* growing between the rock crevices of Fortress Sakksayhuaman (3500 m alt.), Cusco.

152. Fortress Sakksayhuaman (3500 m alt.), Cusco, type locality of *Solanum raphanifolium*.

153. *Solanum sogarandinum* (*Ochoa 1440*, holotype).

154. Caulescent plant type of *Solanum sogarandinum* (*Ochoa 2631*).

155. *Solanum sogarandinum*. Top: subrosette (*Ochoa and Salas 12540*). Bottom: rosette (*Dillon et al. 2928*).

156. Floral dissection of *Solanum sogarandinum* (*Ochoa 12540*).

157. Fruits of *Solanum sogarandinum* (*Ochoa 13324*).

158. Tubers of *Solanum sogarandinum* (*Ochoa 13336*).

OLMOSIANA

159. *Solanum olmosense* (*Ochoa 2473*, holotype).

160. Floral dissection of *Solanum olmosense* (*Ochoa 2473*, holotype).

161. Tubers of *Solanum olmosense* (*Ochoa 13348*).

162. Inflorescence, leaves and flowers of *Solanum olmosense*.

163. Leaves and flowers of *Solanum olmosense*.

164. Habitat of *Solanum olmosense* in the much eroded valley of the River Olmos (April 1992).

PIURANA

165. *Solanum acroglossum* (*Juz. 10672*, type).
166. Floral dissection of *Solanum acroglossum* (*Ochoa 11297*).
167. Fruits of *Solanum acroglossum* (*Ochoa 11297*).
168. Habitat of *Solanum acroglossum*, Panao, Huanuco, 1970.
169. *Solanum ariduphilum* (*Ochoa 2637*, holotype).
170. Floral dissection of *Solanum ariduphilum* (*Ochoa 2637*, holotype).
171. *Solanum cantense* (*Ochoa 1154*, holotype).
172. Floral dissection of *Solanum cantense* (*Ochoa 14692*).
173. Stolons and tubers of *Solanum cantense* (*Ochoa 1154*).
174. Fruits of *Solanum cantense* (*Ochoa 14828*).
175. *Solanum chiquidenum* (*Ochoa 1505*, holotype).
176. Floral dissection of *Solanum chiquidenum* (*Ochoa 1505*, holotype).
177. Fruits of *Solanum chiquidenum* (*Ochoa 1505*, holotype).
178. Tuberization of *Solanum chiquidenum* (*Ochoa 1505*, holotype).
179. Quebrada Chiquiden, Cajamarca, habitat and type locality of *Solanum chiquidenum*.
180. *Solanum chiquidenum* var. *gracile* (*Ochoa and Salas 15229*, holotype).
181. *Solanum chiquidenum* var. *robustum* (*Ochoa 14760*, holotype).
182. Floral dissection of *Solanum chiquidenum* var. *robustum* (*Ochoa 13967*).
183. *Solanum chiquidenum* f. *amazonense* (*Ochoa 2673*, holotype).
184. Floral dissection of *Solanum chiquidenum* f. *amazonense* (*Ochoa 2673*).
185. *Solanum humectophilum* (*Ochoa 2668*, holotype).
186. Leaves, floral parts, fruit, tubers and stolons of *Solanum humectophilum* (*Ochoa 2668*, holotype).
187. Floral dissection of *Solanum humectophilum* (*Ochoa 11753*).
188. Inflorescence of a plant of *Solanum humectophilum* growing in its natural habitat.
189. Habitat of *Solanum humectophilum*.
190. *Solanum hypacrarthrum* (*Ochoa 7423*).
191. Floral dissection of *Solanum hypacrarthrum* (*Ochoa 13272*).

192. Leaf and floral dissection of *Solanum hypacrarthrum* (*Ochoa 2049*).
193. *Solanum paucissectum* (*Ochoa 2321*, holotype).
194. *Solanum paucissectum* (*Ochoa 11631*, topotype).
195. Floral dissection of *Solanum paucissectum* (*Ochoa 11628*).
196. Fruits of *Solanum paucissectum* (*Ochoa 11628*).
197. Floral dissection of *Solanum paucissectum* (*Ochoa 11629*).
198. Fruits of *Solanum paucissectum* (*Ochoa 14816*).
199. Greenhouse specimen of *Solanum paucissectum*.
200. *Solanum piurae* (*Ochoa 2330*, topotype).
201. Tubers of *Solanum piurae* (*Ochoa 13959*).
202. *Solanum yamobambense* (*Ochoa 1431*, holotype).
203. Floral dissection of *Solanum yamobambense* (*Ochoa 1431*, holotype).
204. Leaves of *Solanum yamobambense* (*Ochoa 10722*).

SIMPLICISSIMA

205. *Solanum guzmanguense* (*Ochoa and Salas 15989*).
206. Floral dissection of *Solanum guzmanguense* (*Ochoa and Salas 15989*).
207. Leaf, fruits and tubers of *Solanum guzmanguense* (*Ochoa and Salas 15990*).
208. *Solanum simplicissimum* (*Ochoa 4500*, holotype).
209. Floral dissection of *Solanum simplicissimum* (*Ochoa 14628*).
210. Fruits of *Solanum simplicissimum* (*Ochoa 15147*).
211. Plant of *Solanum simplicissimum* in its natural habitat.
212. Habitat of *Solanum simplicissimum*, near Santa Rosa de Quives, prov. of Canta, March 1979.

TUBEROSA

213. *Solanum acroscopicum* (*Ochoa 5108*).
214. *Solanum acroscopicum* (*Ochoa 2043* holotype).
215. Tubers of *Solanum acroscopicum*.
216. Foreground: Habitat of *S. acroscopicum*, between 3400 and 3700 m alt. Background: Cordillera de Tacna. Photo by C. Ochoa, March 1981.
217. *Solanum amayanum* (*Ochoa 4299*, holotype).

218. Floral dissection of *Solanum amayanum* (*Ochoa 4299*, holotype).

219. Plant of *Solanum amayanum* in its habitat at the type locality (*Ochoa 4299*, holotype).

220. *Solanum ambosinum* (*Ochoa 1040*, holotype).

221. Floral dissection of *Solanum ambosinum* (*Ochoa 14557*), plant collected from near the type locality.

222. Fruits of *Solanum ambosinum* (*Ochoa 14605).*

223. Tubers of *Solanum ambosinum* (*Ochoa 14557).*

224. Km 38 between San Rafael and Ambo, type locality of *Solanum ambosinum* totally deprecated. Photo: February 1982.

225. Greetings from the author at Río Huacar, tributary of the Río Huallaga, about 5 km west of the type locality of *Solanum ambosinum*.

226. *Solanum ancophilum* (Corr.) Ochoa, *sp. et stat. nov*. (*Ochoa 12086*).

227. Floral dissection of *Solanum ancophilum* (*Ochoa 12086).*

228. *Solanum ancophilum* in full flower and fruit at its type locality.

229. Type collection of *S. rhomboideilanceolatum* var. *ancophilum* (*Correll and Smith P957*). Photo: Courtesy of the Department of Botany at the Smithsonian Institution (US).

230. Habitat and type locality of *Solanum ancophilum*, shores of Lake Llanganuco, Ancash.

231. *Solanum ancoripae (Ochoa 13661*).

232. *Solanum ancoripae (Ochoa 13662,* holotype*).*

233. Fruits of *Solanum ancoripae* (*Ochoa 13662*, holotype).

234. Tubers of *Solanum ancoripae* (*Ochoa 13662*, holotype).

235. Banks of the Río Ckella, 3000 m alt., habitat of *S. ancoripae*.

236. *Solanum* × *arahuayum* (*Vilcapoma 208*, holotype).

237 Floral dissection of *Solanum* × *arahuayum* (*Ochoa 11030*).

238. *Solanum augustii* (*Ochoa 3317*, holotype).

239. Floral dissection of *Solanum augustii* (*Ochoa and Salas 15733*).

240. Fruits of *Solanum augustii* (*Ochoa and Salas 15733*).

241. Tubers of *Solanum augustii* (*Ochoa and Salas 15733*).

242. *Solanum aymaraesense* (*Ochoa 4150*, holotype).

243. *Solanum aymaraesense*, floral dissection (*Ochoa 13810*).

244. *Solanum bill-hookeri* (*Ochoa 4295*, holotype).

245. Floral dissection of *Solanum bill-hookeri* (*Ochoa 4295*, holotype).

246. *Solanum bukasovii* (*Juz. 10605*, lectotype).

247. Topotypes of *Solanum bukasovii* (Plant 1: *Ochoa 2379*, Plant 2: *Ochoa 320,* Plant 3: *Ochoa 31*).

248. *Solanum bukasovii*, showing very small plants:

  1. *Ochoa 11853*, collected at Tahualtuco, 3600 m alt., Concepción, Junín.
  2. *Ochoa 11870*, collected at Huaytapallana, 3700 m alt., Huancayo, Junín.

249. *Solanum bukasovii* (*Ochoa 11876*), collected in the vicinity of Jauja, 3450 m alt., Junín, near the type locality of "*S. abbotianum.*"

250. Floral dissection of *Solanum bukasovii* (*Ochoa 13862*), collected at Lloclla, 3800 m alt., near the type locality Yanamachay, Pasco.

251. Floral dissection of *Solanum bukasovii* (*Ochoa 14333*), collected at Chuñunapampa, 3800 m alt., distr. Cachora, Abancay, Apurímac.

252. Floral dissection and leaf of *Solanum bukasovii* (*Ochoa 13859*), collected at Carmen Chico, 3900 m alt., Yanamachay, near the type locality of the species.

253. *Solanum bukasovii* (*Ochoa 2379*), showing a very small plant with its typically large flower, collected at Yanamachay, the type locality of the species.

254. Fruits of *Solanum bukasovii* (*Ochoa 13190*).

255. Fruits of *Solanum bukasovii* (*Ochoa 13684*).

256. Tubers of *Solanum bukasovii* (*Ochoa 13559*).

257. *Solanum bukasovii,* near Yanamachay (today Carmen Chico), Pasco, its type locality, growing under the protection of *Stipa ichu* and in melting snow. Photo C. Ochoa, 1984.

258. *Solanum bukasovii,* facing Yanamachay (today Carmen Chico), 3800 m alt., Pasco, its type locality and habitat.

259. *Solanum bukasovii,* near Yanamachay [or Cueva Negra] (today Carmen Chico), 3800 m alt., Pasco. Photo: C. Ochoa, 1984.

260. Paso de Ticlio, 4842 m alt., diverted waters of the Cordillera Occidental de los Andes between Lima and La Oroya. Photo: C. Ochoa, March 1985.

261. *Solanum bukasovii* f. *multidissectum* (*Ochoa* 37, type of "*S. neohawkesii*").

262. *Solanum bukasovii* f. *multidissectum* (*Vargas 5646 p.p.*, col. "*S. multidissectum*").

263. *Solanum bukasovii* f. *multidissectum* (*Ochoa 2028*), from Aguas Calientes, Department of Cusco.

264. Fruits of *Solanum bukasovii* f. *multidissectum* (*Ochoa 13110*).

265. Tubers of *Solanum bukasovii* f. *multidissectum* (*Ochoa 13586*), *ca.* × 1/1.

266. Plains of Canas, Cusco, habitat of *Solanum bukasovii* and *S. bukasovii* f. *multidissectum*.

267. *Solanum cajamarquense* (*Ochoa 1490*, isotype).

268. Floral dissection of *Solanum cajamarquense* (*Ochoa and Salas 16118*).

269. Fruits of *Solanum cajamarquense* (*Ochoa and Salas 16118*).

270. Tubers and tuberization of *Solanum cajamarquense* (*Ochoa and Salas 16131*).

271. Plant of *Solanum cajamarquense* in its natural habitat.

272. Quebrada just south of San Juan, Cajamarca, habitat of *Solanum cajamarquense*.

273. *Solanum candolleanum* (*Ochoa 4210*).

274. *Solanum chancayense* (*Ochoa 2159*, topotype).

275. Floral dissection of *Solanum chancayense* (*Ochoa 11250*).

276. Tubers of *Solanum chancayense* (*Ochoa 11250*).

277. Plant of *Solanum chancayense* Ochoa (*Ochoa 1804*, holotype).

278. Cerro Latillo, about 2 km northwest of Chancay, type locality of *Solanum chancayense*, January 1988.

279. *Solanum chillonanum* (*Ochoa 4101*, holotype).

280. *Solanum coelestispetalum* (*Vargas 5990*, lectotype CUZ).

281. Floral dissection of *Solanum coelestispetalum* (*Ochoa 15664*, topotype).

282. Floral dissection of *Solanum coelestispetalum* (*Ochoa 15667*, topotype).

283. Fruits of *Solanum coelestispetalum* (*Ochoa 15666*, topotype)

284. Tubers of *Solanum coelestispetalum* (*Ochoa 13597*).

285. Habitat of *Solanum coelestispetalum*, along the trail leading down from Ckosñiriti and Peñas to Ollantaytambo, Cusco.

286. *Solanum gracilifrons* (*Weberbauer-6472*, lectotype).

287. Floral dissection and leaves of *Solanum gracilifrons* (*Ochoa 990*).

288. Floral dissection of *Solanum gracilifrons* (*Ochoa 13117*).

289. Tubers of *Solanum gracilifrons (Ochoa 13117)*.

290. *Solanum huancabambense* (*Ochoa 2573*, topotype).

291. Floral dissection of *Solanum huancabambense* (*Ochoa 2337*).

292. Floral dissection of *Solanum huancabambense* (*Ochoa 11626*).

293. Berries of *Solanum huancabambense* (*Ochoa 14815*), Totoral, Jusgara.

294. Plant of *Solanum huancabambense*, Piura.

295. *Solanum huancavelicae* (*Ochoa and Salas 16272*, holotype).

296. *Solanum huarochiriense* (*Ochoa 11331*, topotype).

297. Floral dissection of *Solanum huarochiriense* (*Ochoa 11329*).

298. Fruits of *Solanum huarochiriense* (*Ochoa 11329*).

299. Tubers of *Solanum huarochiriense (Ochoa 11331*).

300. *Solanum huarochiriense* in its habitat and type locality, Pacomanta, Province Huarochirí, Lima, March 1982.

301. Habitat of *Solanum huarochiriense*, vicinity of Pariacaca, 4000-4200 m alt, Huarochirí, Lima.

302. *Solanum immite* (*Ochoa* 15184).

303. Floral dissection of *Solanum immite* (*Ochoa 11689*).

304. Berries and tubers of *Solanum immite* (*Ochoa 14261*). Notice the corolla persisting on the immature fruits.

305. *Solanum immite* var. *vernale* (*Saunders-185*, type).

306. *Solanum incahuasinum* (*Ochoa 3595*, holotype).

307. Floral dissection of *Solanum incahuasinum* (*Ochoa 11613*).

308. *Solanum incasicum* (*Ochoa 4001*, holotype).

309. *Solanum leptophyes* Bitt., from Antabamba, Department Apurímac, Peru (*Ochoa 13659*).

310. *Solanum leptophyes* Bitt., from Puno, Peru (*Ochoa 10876)*.

311. Fruits of *Solanum leptophyes* Bitt. (*Ochoa 13671*).

312. Tubers of *Solanum leptophyes* Bitt.

313. Habitat of *Solanum leptophyes*, a scene along the railorad line between Chuquibambilla and Vilcabamba, Apurímac.

314. *Solanum longiusculus* (*Ochoa 4125*, holotype).

315. Floral dissection of *Solanum longiusculus* (*Ochoa 4125*, holotype).

316. *Solanum lopez-camarenae* (*Ochoa 11672*, topotype).

317. *Solanum lopez-camarenae* (*Ochoa 3251*), in its habitat, Montañas de Suro Chico, Cajamarca.

318. Floral dissection of *Solanum lopez-camarenae* (*Ochoa and Salas 15228*).

319. *Solanum marinasense* (*Ochoa 2203*, topotype).

320. *Solanum marinasense* var. *dentifolium* (*Vargas 5566*, isotype).

321. Floral dissection of *Solanum marinasense* (*Ochoa 11618*).

322. Fruits of *Solanum marinasense* (*Ochoa 14417*).

323. Tubers of *Solanum marinasense* (*Ochoa 13689*).

324. Quebrada de Arín, Calca, Cusco, 2900-3200 m alt., habitat of *Solanum marinasense.*

325. Quebrada de Kochoj, 3700 m alt., Calca, Cusco, type locality of *Solanum marinasense.*

326. Valle Sagrado, 2800-2900 m alt., Cusco (Pisac, Calca and Urubamba), habitat of *S. lignicaule, S. marinasense* and *S. sparsipilum*; in the background is the great Pico de La Verónica.

327. *Solanum medians* (*Weberbaueri 5683*, lectotype). Photo: Courtesy of the Department of Botany, Smithsonian Institution (US).

328. *Solanum medians,* 2n=36 (*Ochoa 14908).*

329. *Solanum medians*, 2n=36 (*Ochoa 3036*), Lomas de Atocongo, near Lima.

330. Floral dissection of *Solanum medians*, 2n=36 (*Ochoa 11261*), specimen collected at the Lomas de Posco, near Cachendo, 500-900 m alt., Islay, Arequipa.

331. Tubers of *Solanum medians*, 2n=36 (*Ochoa 11267*), collected at the Lomas de Camaná, Quebrada del Toro, 900 m alt., Arequipa.

332. Living plant of *Solanum medians*, 2n=36 (*Ochoa 14908*), propagated at La Molina from tubers collected at its type locality.

333. Habitat of *Solanum medians*, Lomas de Ilo, Moquegua, near the Pacific Ocean, 150-350 m alt.

334. Lomas de Mongomarca, near Amancaes, Lima, type locality of *Solanum medians*, today strongly deprecated. Photo: June 1988.

335. Habitat of *Solanum medians*-3x, Lomas de Posco, 500-900 m alt., Islay, Arequipa.

336. Habitat of *Solanum medians*-3x, Lomas de la Buitrera 350-400 m alt., Moquegua.

337. *Solanum medians* var. *autumnale*, 2n=24 (*Ochoa 691*).

338. *Solanum medians* var. *autumnale*, 2n=24 (*Ochoa 11884*).

339. *Solanum medians* var. *autumnale*, 2n=24 (*Ochoa 11259*) from the Quebrada de Cachullo, south of the Lomas de Posco.

340. *Solanum medians* var. *autumnale* (*Weberbauer 1575*, type collection of *S. weberbaueri*). Photo: Courtesy of the Field Museum of Natural History (F).

341. Floral dissection of *Solanum medians* var. *autumnale* (*Ochoa 12047*), from a specimen collected at Surco.

342. Floral dissection of *Solanum medians* var. *autumnale* (*Ochoa 13264*), from a specimen collected at Huinco-Seque, Santa Eulalia, Lima.

343. Floral dissection of *Solanum medians* var. *autumnale* (*Ochoa 11249*), from a specimen collected at Caracoles-Pucusana.

344. Floral dissection of *Solanum medians* var. *autumnale,* 2n=24 (*Ochoa 11259*) from Canchullo, Lomas de Posco, Arequipa.

345. Fruits of *Solanum medians* var. *autumnale* (*Ochoa 12047* and *11637*).

346. Tubers of *Solanum medians* var. *autumnale,* 2n=24 (*Ochoa 12047*), collected at San Pedro de Casta, Huinco, Lima.

347. Habitat of *Solanum medians* var. *autumnale,* Cañón del Rímac, 3000 m alt., between Tambo de Viso and San Mateo, along the Lima-La Oroya road.

348. *Solanum mochiquense* Ochoa (*Ochoa 10724*).

349. *Solanum mochiquense* Ochoa (*Ochoa 1822*, holotype).

350. Floral dissection of *Solanum mochiquense* (*Ochoa 3658*), from a specimen collected at Cerro Campana, near Trujillo, La Libertad.

351. Fruits of *Solanum mochiquense* (*Ochoa 14820*).

352. Tubers collected at Cerro Campana, near Trujillo, La Libertad, *Solanum mochiquense* Ochoa (*Ochoa 14870*).

353 *Solanum mochiquense* Ochoa, near El Chorrillo, above Cascas, 2700 m alt., along the road to Contumazá, Province Contumazá, Cajamarca, May 1982.

354. The dry mountain called Cerro Campana, near Trujillo, La Libertad, type locality of *Solanum mochiquense* Ochoa.

355 *Solanum multiinterruptum* (*Ochoa and Salas 12579*, flowers blue).

356. *Solanum multiinterruptum* (*Ochoa and Salas 12586*, flowers sky-blue).

357. Floral dissection of *Solanum multiinterruptum* (*Ochoa and Salas 12586*, flowers sky-blue).

358. Floral dissection of *Solanum multiinterruptum* (*Ochoa and Salas 12579*, flowers blue).

359. Floral dissection of *Solanum multiinterruptum* f. *albiflorum* (*Ochoa and Salas 12584*).

360. Fruits of *Solanum multiinterruptum* (*Ochoa 15186*).

361. Tubers of *Solanum multiinterruptum* (*Ochoa 11690*).

362 *Solanum multiinterruptum* var. *machaytambinum* (*Ochoa 2164*, isotype).

363. *Solanum multiinterruptum* f. *albiflorum* (*Ochoa and Salas 12584*, holotype).

364. *Solanum* × *neoweberbaueri* (*Ochoa 11248*).

365. Leaf and floral dissection of *Solanum* × *neoweberbaueri.*

366. *Solanum orophilum* (*Ochoa 13023).*

367. *Solanum orophilum* (*Correll and Smith P971*, lectotype). Photo: Courtesy of the Department of Botany at the Smithsonian Institution (US).

368. Floral dissection of *Solanum orophilum* (*Ochoa 13023).*

369. Fruits of *Solanum orophilum* (*Ochoa 13003).*

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429. Floral dissection of *Solanum yungasense*-3x (*Ochoa and Salas 15029*).

430. *Solanum yungasense*-3x, in its natural habitat, vicinity of the Village of San Juan del Oro, 1500 m alt., Sandia, Puno.

PREFACE

This book on the wild potatoes of Peru spans more than three decades of my work at the International Potato Center (CIP) in Lima, Peru, and has been prepared for the worldwide scientific community as Part 1 of a planned series of works on "The Potatoes of South America: Peru" (the second part of whichwill cover the cultivated species). Another volume of this series, a systematic treatment of the potatoes of Bolivia, was published in 1990.

The present monograph, a biosystematic work on the wild potatoes of Peru, accounts for nearly 50% of the taxa that occur in this tuber-bearing group of New World *Solanum* species. Included within it are pen and ink drawings of the various species, floral dissections, habitat photos and distribution maps. The finely executed watercolor paintings in this work are by the distinguished artist and plant pathologist, Dr. Franz Frey.

In addition to my personal herbarium, accumulated over several decades, I have examined more than 4000 collections of wild Peruvian potatoes from herbaria in the United States, Europe and South America. A large part of the collections that I examined at the Museum of Natural History, Washington, D.C., were obtained on loan from various other museums in Europe and the United States through the kind auspices of Dr. Dieter Wasshausen, botanist and staff member of the Smithsonian Institution. Other collections were examined at the Vavilov Institute of St. Petersburg, Russia, the Javier Prado Natural History Museum at Lima, the University of Trujillo, the National Agrarian University at La Molina, and the Vargas Herbarium at the University of Cusco.

This material was supplemented by the living collections maintained by the CIP- Experimental Stations at Huancayo and La Molina, the National Agrarian University at La Molina, the K'ayra Experimental Station of the University of

Cusco and the U.S.D.A. facility at Sturgeon Bay, Wisconsin. Care was taken to record any or all modifications of the plant that appeared to have been environmentally induced. One such example involves plants grown in the experimental fields and greenhouses of Huancayo and K'ayra. The high altitude locations of these two sites replicate growing conditions as they occur in nature. Significantly, plants grown at these upper altitudes are often strikingly different in morphology from those propagated at much lower elevations in the United States at Sturgeon Bay or in Russia at St. Petersburg (formerly Leningrad) and Pushkin.

Considering the large number of tuberous *Solanum* species known for Peru, comparatively little has been done with regard to their possible use in potato improvement programs. There is still much to learn, for example, about the causes of infertility between the species of this group. Modern researchers, it would seem, have barely touched upon this topic. For these and other reasons relating to the phylogenetic ordering of this group, I have chosen to include the results of my own interspecific crossing program, which has involved the use of literally thousands of different accessions. Although the great majority of the crosses that were made in connection with the present work were not taken beyond the F_1 generation, this level of information proved to be adequate for the assessment of taxonomic distance between species. The relationship between chromosome number, numerical endosperm balance and the degree of success or failure in crossing was also investigated, as were the fertility of hybrids obtained in interspecific crosses. In general, species yielding highly fertile offspring in crosses were considered to be more closely related to one another than those that produced fewer offspring or were sterile.

In the course of these investigations, special emphasis was given to the problems relating to the use of the numerical endosperm balance as both an evolutionary and taxonomic character. Thus, care was given to the inclusion of both the chromosome number and the value of the numerical endosperm balance for each of the known Peruvian wild species. Where applicable in the text, tables detailing this information have been included under the paragraph headings entitled, "Breeding Potential."

Over the past century many scientists from this country and abroad have contributed greatly to our knowledge of the wild and cultivated species of potato through field and laboratory explorations. Nonetheless, there remain many remote and isolated areas of the country that should be visited. Such areas include the Departments of Apurímac in southern Peru and Huancavelica in the central sierras, and various locales to the NW of the Peruvian Andes.

Finally, it is the author's hope that the biosystematics of the wild potatoes of Peru may prove to be of value to the general scientific community. Peru is the place of origin and domestication of the cultivated potato, as well as the homeland of its closely related ancestral species. Because of the great diversity and genetic potential of the Peruvian wild species, many of which still remain unevaluated with respect to their possible horticultural use, the opportunities for doing future research in the field of potato improvement programs would appear to be endless.

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HISTORICAL REVIEW

The following is a brief review of the Peruvian species of potato from the time of their initial discovery to the present time. The first literature reference on this subject appears in an article by Ludovico Bertonio, S.J., who resided for a time in Juli, Puno. In his *Vocabulario*, he indicated that the native name of *Apharu* applies to a wild bitter-tasting species of potato (Bertonio, 1612, *Voc. Aym.* 2nd part, p. 23). However, the first actual descriptions of Peruvian potatoes were not published until the middle part of the nineteenth century. In 1841, for example, D.F.L. von Schlechtendal published the species *Solanum triferum* in his *Hortus Halensis, tam vivus quam siccus* (Vol. 1, p. 6). A short time later, Michel Felix Dunal published *S. immite* in De Candolle's *Prodromus* (1852, Vol. 13, Part 1, page 32). Unfortunately, the location of the type specimen of *S. triferum* (if still in existence) is not presently known. The type specimen of *S. immite*, however, which has been preserved to this very day in the herbarium of the *Real Jardín Botánico*, Madrid, is part of a larger general collection of plants that were assembled by Hipólito Ruiz and José Pavón during their botanical collecting expedition to the "Kingdom of Peru," the latter sponsored by the Spanish monarch, Carlos III, between the years 1778 and 1781 (Ochoa, 1992, p. 203). The actual site of collection of *S. immite*, a species that was referred to by the above mentioned explorers as the "Potatoes of Peru", was Chancay, a village situated on the coast and but a few kilometers north of Lima (Ruiz and Pavón, *Flora Peruviana Prodromus* 1794, Vol. 2, p. 38).

In addition to *S. immite*, Dunal also described the Peruvian species *S. lycopersicoides* in De Candolle's *Prodromus* (*ibid*, p. 38). Although considered to be related to the tuber-bearing species of *Solanum* on the basis of the very high articulation of the floral pedicels, in reality there are many features of this species that tend to keep it distinct from that group, including its woody stem, shrubby branching habit, and bright yellow, rotate corollas. Moreover, and most significantly, this species is not known to be tuber-bearing. Dunal's description of *S. lycopersicoides* was based on a collection made by Alcides D'Orbigny in the Quebrada de Palca (Department and Province of Tacna) during his journey from Tacna to La Paz (D'Orbigny, 1945, Vol. III, Chapter XXV, p.958). The type specimen of *S. lycopersicoides*, which was probably collected by D'Orbigny on the 20th of May, 1830, is presently housed in the Museum of Natural History in Paris (see Ochoa, 1953, pp. 127-131, for a more complete account of this rare Peruvian species).

Another Peruvian species similar to *S. lycopersicoides* in having non tuber-bearing woody stems, yellow flowers and pedicels that are articulated above center, is *S. ochrantum*. This species, which was originally collected by Humboldt and Bonpland near Quito, Ecuador, was described as new by Dunal (*Synopsis*, Montpellier 6, 1816). Additional localities were this species grew were discovered in 1844 in Colombia by J. Goudot, and in Peru by Weberbauer between the years 1909 and 1914.

The Peruvian-Bolivian species *S. candolleanum* Berthault was first described by Alfonso De Candolle in 1886 under the name *S. mandonii*. However, as this name was later discovered by Berthault to be preempted by an even earlier-described non tuber-bearing *Solanum* species, it was soon designated as a homonym and relegated to synonymy (Ann. Sci. Agron. Et Etrang., Paris 3, Ser. 6th year, Vol. 2:184-185, 1910-1911). Although this species was at first known only from Bolivia, it has since been found to grow abundantly in the Province of Sandia, Department of Puno, in southeastern Peru (*cf.* Ochoa, 1990) together with *S. yungasense*, another species formerly thought to be endemic to Bolivia.

The second decade of the twentieth century was particularly notable as it ushered in the contributions of George Bitter, a German botanist. Working with collections made by Andrew Mathews in 1832 at the Cuesta de Puruchuco (Province Canta, Department Lima), Bitter described the species *S. hypacrarthrum* and *S. mathewsii* (see Repert. Spec. Nov. 11:367, 1912 and 12:53, 1913). In this same period, Bitter proposed for the first time the use of taxonomic series (or "Reihe") as an aid in the classification of closely related groups of potato species, choosing for his first sample group, the Conicibaccata (*ibid*, 11:381, 1912). Other taxa named by Bitter include the species *S. wittmackii*, which was described from collections made by Mathews in 1833 at the Lomas de Amancaes, near Lima, and *S. wittmackii* var. *glauciviride*, the type specimen of which was collected at the same locality by Edward André in July 1876. Today, these two taxa can no longer be found at this location due to the many human settlements that dot the area. Bitter also based a number of his new species on collections made by the German phytogeographer, Augusto Weberbauer, who resided in Peru for more than 40 years (Weberbauer, 1945). New species described during the Weberbauer period include *S. medians* from the Lomas de Mangomarca near Lima (*ibid*, 11:366, 1912), the habitat of which is no longer in existence today; *S. medians* var. *majorifrons* and *S. medians* var. *majorifrons* subvar. *photohypoleucum*, the type specimens of which were collected by Jean Bautist Martinet at Tambo de Viso in the Rimac Canyon, near Lima (*ibid*, 12:149-150, 1913); *S. weberbaueri* (*ibid*, 11:365, 1912) from the Lomas de Tambo, Department of Arequipa, another site where the habitat is swiftly disappearing due to the inroads of human settlements; *S. gracilifrons* (Engl. Bot. Jahrb., No. 119, 54:6, 1916), an exotic and very rare species, the type of which was collected at Mantacra-Colcabamba, Department of Huancavelica, in central Peru; *S. piurae* (*ibid*, No. 54, 119:5, 1916), from Ayabaca, Department of Piura, in the northern part of the country; *S. laxissimum* (*ibid*, No. 54, 119-17, 1916), from the Department of Junín in central Peru; and, *S. chomatophilum* (Abhaudl. Naturaw, see Bremen 25:246, 1922), a species collected by Weberbauer in the Province of Pallasca, Department of Ancash, in northern Peru).

In addition to the above species, Bitter also described *S. dolichocremastrum* (Repert. Spec. Nov. 12:3, 1913). The latter species is known to have been collected by Dombey, but the holotype, which is stored in the Museum of Natural History of Paris, lacks the date and place of collection. However, from his itinerary, it would seem that Dombey probably collected the plant in the Department of Huánuco between the years 1779 and 1781 (Ochoa, 1962, p. 239). Similarly, the date of collection is not known for tuberous Peruvian species described by Bitter as *S. multiinterruptum* (Repert. Spec. Nov. 12:56, 1913). In this case, the collector, John McLean, is known to have visited the collection site of Huamantanga (near Lima) probably between the years 1832 and 1834. The type specimen of this species, which lacks a field number, is stored in the herbarium of Kew Gardens, London, England. Finally, there is the case of the wild potato species that was collected by Weberbauer (No. *5689*) at Morro Solar, near Chorrillos, in the Department of Lima, but never endowed with a scientific name by him. This was done later by Ludwig Wittmack, who called the new species *S. neoweberbaueri* (Engl. Bot. Jahrb. 50, 540-548, 1914).

Bitter also described several new Bolivian plants between the years 1912 and 1913. These were based on collections made by the German botanists Karl Fiebrig in 1904 and Otto Buchtien in 1907 and 1913. These new taxa of wild tuber-bearing plants, which, by the way, also occur in Peru, are *S. acaule* (Repert. Spec. Nov. 11:391, 1912), *S. acaule* var. *subexinterruptum* (*ibid*, 11:393, 1912), *S. megistacrolobum* (*ibid*, 10:536, 1912), *S. leptophyes* (*ibid*, 12:448-449, 1913), and *S. tuberosum* subsp. *sparsipilum* (*ibid*, 12:152, 1913). In addition to the treatments found in the present work, these Bolivian-Peruvian species are also dealt with by Ochoa (1990).

Unfortunately, all the type collections used by Bitter in the description of his new species were destroyed in an accidental bombing of the Berlin-Dahlem Museum during an Allied airforce raid in World War II. Many isotypes of these specimens, however, do exist in various herbaria throughout Europe and the United States. However, it is a sad reflection on the present state of our collections that only two of Bitter's original isotypes (a specimen each of *S. gracilifrons* and *S. laxissimum*) are presently stored in Peru. Both are housed in the collections of the old Escuela Nacional de Agricultura, La Molina, which is known today as the Universidad Nacional Agraria de La Molina (MOL). This is the institution where Weberbauer had worked for so many years.

Early in 1913, David Fairchild, of the United States Department of Agriculture, sent explorers and plant collectors to Central and South America, Africa and Asia. This was much earlier in time than the expeditions that were sent out to different parts of the world by the Russian scientist, N. I. Vavilov. Among the collectors Fairchild sent to South America was botanist W.F. Wight, who, upon arriving in June of 1913, set out to explore Argentina, Bolivia, Chile and Peru (Wight, 1916). Wight made many general collections of South American native crops and flora, including some wild and cultivated species of potato (USDA, 1916). In Peru, he visited Cusco, Arequipa, Lima, La Oroya and Tarma. Seeds of various wild potato species were collected by Wight in the vicinity of the cities of Sicuani, Quiquijana and Arequipa. His work established in many ways a historical milestone in the utilization and study of Peruvian potatoes.

In Peru, the first person to attempt a classification of Peruvian potatoes was Fortunato L. Herrera. His 1921 "folk" classification of the wild and cultivated potatoes of the Department of Cusco in southern Peru subdivided the group into three categories depending upon whether the plants were sweet, bitter or wild. Moreover, with respect to the sweet and bitter types, which together constituted more than 50 different native types, this group was subdivided by Herrera on the basis of whether the tubers were round, elongated, flat or twisted (Herrera, 1921, 1930-1933).

The decade of the thirty's was particularly fruitful with respect to the development of classifications treating the native cultivated potatoes of Peru. One of the earliest classifications of this period was developed by Senefelder Vallejo. He attempted to subdivide the Peruvian and European potatoes of the Huaraz region in northern Peru into early and late sprouting varieties (Vallejo, 1932). Moreover, he was also responsible for the shipping of a large number of native potatoes from the Department of Ancash to Leningrad, where they were subsequently studied by Lechnovitch (1940). Several new varieties of S. *andigenum* were to come out of this, including *elongatipedicellatum*, *huarasicum* and *vallejosii*. Following this, we see the work on potatoes previously begun by Herrera in southern Peru being added to by Vargas, who wrote a detailed treatment of the cultivars of the Paucartambo region in the Department of Cusco (Vargas, 1936). In Halle, Germany, von Rathlef (1936), working with living collections and using the classification schemes of Juzepczuk and Bukasov (1929), wrote primarily about the indigenous potatoes of Cusco and Ancash. And finally, there was Jaroslav Soukup (1939), who during his temporary residency in the city of Puno in southern Peru, wrote a large and important systematic treatment of the cultivated potatoes of the Department of Puno.

In 1924, Axel Rydberg published a classification of the tuberous species of *Solanum* of Mexico and Central America in which he proposed certain new but poorly defined series and species. Among the former were the series Tuberosa and Juglandifolia (Rydberg, 1924, 51:146, 147, and 173), both of which are widely distributed, but are found mostly in South America.

In 1925, Professor Nicolai Ivanovitch Vavilov, Director of the Institute of Applied Botany in Leningrad, sent a scientific expedition to the Americas to search for potato germplasm. Vavilov, who at the time was known the world-over for his ideas on agricultural centers of origin, appointed Sergei M. Bukasov to lead an expedition to Mexico, Guatemala and Colombia; whereas, the South American countries of Peru, Bolivia and Chile were to be explored by Juzepczuk (Bukasov, 1930; Juzepczuk and Bukasov, 1929). Although a detailed itinerary of Juzepczuk's expedition was never published, it is known that following his arrival in Lima early in 1927, he visited the Departments of Junín and Pasco in the central region of the country and the Department of Cusco in southern Peru. In central Peru, Juzepczuk collected plants in the vicinity of La Oroya, Huancayo, Huasahuasi and Tarma, as well as in the Chanchamayo river valley and at La Merced. Afterwards, he traveled to Carhuamayo and Cerro de Pasco, Cajamarquilla, Ticlacayán, as well as other nearby places before returning to Lima. From Lima, he traveled by boat to Mollendo, and then by land to Arequipa, Juliaca and Cusco. In Cusco, he had the helping hand of Professor Fortunato Herrera, who was responsible for orientating and advising him on the best ways to go about his field work. Striking out from Cusco, Juzepczuk visited the high regions of Paucartambo, Pomacanchi, Ccorau, Pisac and Chinchero, as well as many other localities famous for their native cultivated potatoes. He also made a brief excursion to the subtropical region of Quillabamba, which he reached by the route running from Ollantaytambo and the Urubamba Canyon toward the localities of Santa Rita and Ckellu Unu. Following his work in Cusco, he traveled along the long quebrada of the Vilcanota, and finally made his way to Puno, where he collected potatoes in the vicinity of the Lake Titicaca basin. Afterwhich, Juzepczuk headed for the Peruvian-Bolivian altiplano, and then made his way to La Paz, Bolivia, arriving there in the middle of August, 1927. Then, following a total of eight months in the mountains of central and southern Peru, Juzepczuk continued his collection activities in Bolivia and Chile until sometime in 1928, when he returned to his own country following a trip to Buenos Aires and Río de Janeiro.

The living collections of seeds and tubers that Juzepczuk collected as well as some of his herbarium specimens were shipped to the Institute of Plant Industry at Leningrad (today Saint Petersburg). His remaining herbarium specimens were deposited in the herbarium of the Komarov Institute of Botany (Juzepczuk's personal domain). In Pushkin, near Leningrad, Juzepczuk collaborated with Bukasov in the study and description of the living material that had been collected by Juzepczuk. Surprisingly, these combined efforts resulted in the publication of ten new species, including *S. andigenum*, *S. ajanhuiri*, *S. curtilobum*, *S. chaucha*, *S. goniocalyx*, *S. juzepczukii*, *S. mammilliferum*, *S. phureja*, *S. stenotomum* and *S. tenuifilamentum* (Proc. U.S.S.R. Congr. Genet. 3:603-609, 1929). Bukasov (1933), moreover, not being totally content with the classification of the above species, found reason to describe numerous varieties and forms. Two of the above species, *S. ajanhuiri* and *S. phureja*, which were thought to be endemics to Bolivia at the time of Juzepczup, have since been discovered in Peru (Ochoa, 1952, 1958). An eleventh cultivated species, *S. chocclo*, which Juzepczuk and Bukasov proposed somewhat later for Peru, is without a Latin diagnosis and is thus classified as a *nomen nudum* (in Vavilov, 1937). But, perhaps the greatest contribution of the various Russian scientists who worked on the plants brought back by Juzepczuk, was the discovery by Rybin (1929, 1933) of a polyploid series in *Solanum*, the chromosome numbers of which ranged from $2n=24$ to $2n=36$, $2n=48$ and $2n=60$. Lastly, Bukasov, believing that he had discovered two new species of wild potatoes, published the names *S. maydiforme* (Bukasov, Bull. Appl. Bot., Leningrad, Ser. 2(2):46, 1933) and *S. pauciflorum* (Bukasov, Bull. Appl. Bot., Leningrad, Ser. A (10), 51-60, 1934). However, as he did not include a formal diagnosis of either one of these entities (or given the names of other publications where they might have been more fully described), there is no other choice than to consider these proposed names of Bukasov as *nomen invalidum*.

Shortly after the publication of the above ten new species by Juzepczuk and Bukasov, the United States and several European countries sent out expeditions to explore for potatoes in the New World. No doubt, the work of the Russians provided a stimulus for others to collect similar lines of wild and cultivated germplasm. However, the majority of the expeditions that set forth concentrated primarily in the collection of the native cultivated varieties of South American potatoes, and the wild species were largely ignored. Among the explorers that were sent out was Rudolph Schick (1930) of the Erwin Bauer Institute in Germany. He collected samples of potatoes in Peru, Bolivia and Argentina. After World War II, his germplasm collections were taken over by the Institute for Plant Breeding at Gross Lüsewitz, the latter founded in 1949. Here, his collections are maintained to this very day (Vandrey *et al.*, 1994). Between 1930 and 1932, the United States Department of Agriculture sent an expedition to Peru, Bolivia and Chile that was headed by H.G. MacMillan and C.O. Erlanson (U.S.D.A., 1934), while the Institute for Plant Breeding at Svalof, Sweden, sent C. Hammarlund (1943) to collect the native cultivated potatoes of southern Peru and Bolivia. A Dutch expedition to Peru and Bolivia, headed by H.J. Toxopeus (1956) of the Institute for Plant Breeding in Wageningen, Holland, amassed a large germplasm collection that eventually was sent back to Europe. Their work was aided by the author (see Ochoa, 1958).

Almost ten years after his voyage to South America, Juzepczuk (1937) published the eight new species of wild potato that he had gathered in Peru, four were from the central highlands (*S. bukasovii*, *S. abbottianum*, *S. acroglossum* and *S. punae*), and four were from the Department of Cusco (*S. aracc-papa*, *S. catarthrum*, *S. herrerae* and *S. urubambae*). One year later, Bukasov proposed another new wild species for the Cusco area, *S. kaufmanii*, but as he neglected to publish a Latin diagnosis, this became another *nomen nudum* (Bull. Acad. Sci U.S.S.R. Ser. Biol. 715, 1938). The plant Bukasov studied was grown in Leningrad from tubers collected by Kaufman at K'ayra, south of Cusco, in November 1928.

Juzepczuk did not leave any of his duplicate collections in Peru. However, thanks to an agreement that was reached with Professor Dr. Armen L. Takhtajan, the former Director of the Komarov Botanical Institute, the author was able to exchange isotypes of plants he collected in Peru for ones that were originally collected by Juzepczuk. Similarly, some isotypes and phototypes of the cultivated species studied by Juzepczuk and Bukasov were acquired by the author, this made possible through the gracious help of Professor Bukasov of the Institute of Plant Industry in Leningrad. Thus, after spending more than a half century in Europe, these collections have, at long last, been returned to Peru, and are now being maintained in the herbarium of the author.

Toward the end of 1932, the eminent N.I. Vavilov spent a few days in Peru following an extensive collecting trip to North America, Central America and Ecuador. During his stay in Lima and its environs, he visited the *lomas* near Chorrillos. Here, he collected a wild tuber-bearing species of *Solanum* that was later to be propagated near Leningrad. Juzepczuk and Bukasov studied this plant, and believing that it was new, called it *S. vavilovii* in Vavilov's honor (Bull. Acad. Sci. U.S.S.R. Ser. Biol. 2:302, 1937).

Beginning in the early 1940's, taxonomic work in Peru took a new turn with the emergence of a series of papers by Professor Dr. César Vargas C., who succeeded the famous Professor Fortunato L. Herrera as a Lecturer in Systematic Botany at the National University of Cusco. Often termed a "botanical pioneer" for his taxonomic work on the Peruvian potatoes, Vargas (1943, pp. 396-398) was responsible for publishing the very first paper that dealt specifically with new wild species of potato for the Department of Cusco. In this he describes the species *S. buesii*, *S. lignicaule*, *S. santolallae* and *S. santolallae* var. *acutifolium*. Then, a short time later Vargas (1946, p.46) proposed (but as *nomen nudum*) the species *S. amabile*, *S. coelestispetalum*, *S. pillahuatense* and *S. villuspetala*. Again, three years later, Vargas (1949, pp. 83-85 and 90-95) proposed without Latin diagnosis the names *S. marinasense*, *S. pillahuatense*, *S. villuspetalum* and *S. multiflorum*. However, in 1956, these names were consolidated with Latin descriptions and a number of new ones were added to the list, including *S. apurimacense*, *S. espinarense*, *S. longimucronatum*, *S. membranaceum*, *S. ochoae* and *S. rockefelleriae*, as well as the varieties *S. calcense* var. *urubamba*, *S. canasense* var. *alba*, *S. canasense* var. *calcense*, *S. canasense* var. *intihuatanense*, *S. lechnoviczii* var. *latifolium*, *S. lignicaule* var. *longistylum* and *S. marinasense* var. *dentifolium* (*cf.* Vargas, 1956, pp. 53-63). The type collections of the species and varieties described by Vargas are found today in the herbarium of the Department of Botany at the National University of Cusco (CUZ). Also to Vargas' credit is the fact that he brought together and organized the large living collections of the university at Cusco. These accessions, identified as C.V.C and approaching one thousand in number, are representative of the native potatoes of the Departments of Apurímac, Cusco, Puno and Tacna. They were classified by Vargas according to the system proposed by Juzepczuk and Bukasov (see Vargas, 1949 and 1956).

In 1939, the government of Great Britain sent E.K. Balls, W. Balfour Gourlay and J.G. Hawkes on an expedition to Mexico, Argentina, Bolivia, Peru, Ecuador and Colombia. The group arrived in Lima in the middle of January 1939, and after a brief rest continued by ship to Mollendo, after which they traveled by land to Puno and, via Guaqui, to Bolivia and Argentina. Balls and Hawkes returned from Argentina to Peru at the end of April 1939. They began their collecting in Puno and continued their voyage to Cusco and several nearby areas, including Paucartambo, Ollantaytambo and Urubamba. From Cusco they headed north via the central route from Abancay and Andahuaylas to Huancayo, where they arrived at the end of May, and, after a short visit, returned to Lima via La Oroya. In early June 1939, they sailed from Callao to Guayaquil, Ecuador.

Among the new taxa of wild Peruvian potatoes that Hawkes published in 1944 (Bull. Imp. Bur. Pl. Breed. & Genet., Cambridge, p. 113, 115, 123-125) following his return from the British expedition were *S. acaule* var. *checcae*, *S. calcense*, *S. canasense*, *S. fragariaefructum*, *S. lechnoviczii*, *S. multidissectum*, *S. pampasense*, *S. pumilum* (this epithet recently corrected to read *S. sicuanum* by Hawkes, 1990, p. 148), *S. punoense*, *S. soukupii* and *S. vargasii*. New cultivated taxa from Peru that were published by Hawkes (1944, pp. 129-131) following his return from that expedition included *S. coeruleiflorum*, *S. churuspi*, *S. yabari* var. *pepino*, *S. yabari* var. *cuzcoense*, *S. juzepczukii* var. *parco*, *S. chaucha* f. *roseum* and *S. chaucha* f. *purpureum*.

All in all, nearly 1000 living collections were gathered by the British expedition, including local donations. Following the arrival of these Commonwealth Potato Collections (CPC) in England, they were initially maintained at the Potato Virus Research Station in Cambridge. Later the collections were transferred to the Scottish Plant Breeding Station at Edinburgh, and finally to the Scottish Crop Research Institute, where they remain today (Wilkinson *et al.*, 1994). The herbarium specimens collected by this expedition, including the types, are deposited in the herbarium of Kew Gardens (K), near London, and at CPC. Unfortunately, no specimens were given to any institution in Peru. Only the isotypes of *S. calcense*, *S. multidissectum* and *S. pumilum* are found in the herbarium of the National University of Cusco (CUZ). However, there are isotypes of the last two species in the herbarium of the Field Museum in the United States (F), and one isotype of *S. pumilum* is found in the collections of the Smithsonian in the United States (US).

In a 1946 joint publication of Cárdenas and Hawkes, there appears among other new entities the species *S. hawkesii*, which was described from Machu Pikchu, Cusco, and *S. werberbaueri* var. *poscoanum*, which was originally collected at the *lomas* of Posco, Arequipa. In this same paper, these authors also describe a new Bolivian species, *S. toralapanum*. The latter species, the range of which is known today to extend into Peru, is treated by Ochoa (1990, pp. 170-180) as simply a variety of *S. megistacrolobum*.

Finally, in 1956 Hawkes described the wild Peruvian species *S. sandemanii*, which was based on a collection made by F.W. Pennell in the vicinity of Arequipa in April of 1925.

The next explorer to visit Peru, Donovan S. Correll of the United States, worked initially for the U.S.D.A. (1947-1956). Later, he became Director of the Systematic Section of the National Science Foundation, and, after that, Head of the Botanical Laboratory at the Texas Research Foundation (1957-1960). Correll's collections of the tuber-bearing species of *Solanum* come from North America, Central America and South America. His living collections are maintained largely by the Potato Introduction Station at Sturgeon Bay, Wisconsin, while the herbarium specimens he collected are deposited principally at the Lundell Herbarium (LL) in Texas and the Smithsonian Institution (US) in Washington. Some of his major scientific contributions to the field of potato taxonomy appear in *Wrightia* (2:169-197, 1961). Another major contribution of Correll was his monograph, *The Potato and Its Wild Relatives* (1962).

Correll's 1962 work on the potato, by the way, also includes an important chapter on the classification of the cultivated potatoes by Kenneth S. Dodds of the John Innes Institute of England. Dodds spent four months collecting potatoes in the Andes along with Graham J. Paxman in 1960. The two investigators visited not only Peru, but also Venezuela, Colombia, Ecuador and Bolivia (Dodds and Paxman, 1962). The horticultural classification of the cultivated potatoes that emerged from this work is unlike that of any other in that it groups all varieties of the cultivated potato with the exception of two hybridogenic forms (*S.* × *juzepczukii* and *S.* × *curtilobum*) under a single species, *S. tuberosum* (Dodds, 1962).

Correll, who arrived in Peru in March 1958, was joined in his collecting expedition by Earl Smith. Smith, at the time, was residing in Lima as a member of the International Cooperation Administration. Together, the two visited Canta, Chavín, Cajamarca, Huamachuco, Huaraz and other places. In Cusco, they were assisted in their endeavors by César Vargas, and in Lima by Ramón Ferreyra and by the present author.

Among the new Peruvian taxa of tuber-bearing *Solanum* that were described by Correll are the following six species: *S. earl-smithii*, *S. claviformum*, *S. moniliforme*, *S. chavinense*, *S. hastiforme* and *S. orophilum* (Correll, 1961, pp. 135, 174, 182, 185, 187 and 192). Several new varieties were also proposed, including *S. immite* var. *vernale*, *S. jalcae* var. *pubescens*, *S. medians* var. *autumnale* and *S. rhombilanceolatum* var. *ancophilum* (Correll, 1961, pp. 181, 190-191 and 197). New forms that were described by Correll include *S. chomatophilum* f. *angustifoliolum* (distributed in both Peru and Ecuador), *S. chomatophilum* f. *pilosum* (common to Colombia and Peru) and *S. santolallae* f. *velutinum* (Correll, 1961, pp. 176 and 180).

Correll also made certain nomenclatorial changes (or *comb. nov.*) in species and varieties proposed previously by other authors. For example, he switched Vargas' var. *xerophyllum* from the species *S. lechnovichii* Hawkes to the species *S. canasense* Hawkes (Correll, 1961, p. 185). The species *S. neohawkesii* Ochoa and *S. sandemanii*, on the other hand, were lowered in rank to varieties under *S. canasense* Hawkes and *S. tacnaense* Ochoa, respectively (Correll, 1961, pp. 184 and 196); whereas *S. rockefelleri* Vargas, *S. longimucronatum* Vargas and *S. neoweberbaueri* Wittmack were reduced to forms under *S. laxissimum* Bitt., *S. marinasense* Vargas, *S. medians* Bitt. and *S. tacnaense* Ochoa, respectively (Correll, 1961, pp. 175, 181 and 191). Similarly, Correll reduced the var. *decurrentialatum* of *S. weberbaueri* to the rank of a form under *S. tacnaense* (Correll, 1961, p. 197).

In 1959, West Germany sent a potato expedition to South America headed by Hans Ross, of the Max Planck Institut für Zuchtungsforschung (Ross, 1960a), with the participation of R. Rimpau and L. Diers. After embarking in Montevideo, Uruguay and spending some time collecting in Argentina and Bolivia, Ross and Rimpau headed for Puno, Peru, via Desaguadero, arriving there on April 1, 1959. In Puno, they met with César Vargas, who accompanied them throughout the greater part of their Peruvian collection trips. From Puno, the expedition crossed the Livine Pass between Tarata and Tacna and traveled on to Moquegua. After stopping briefly at Arequipa, they traveled on to Juliaca, and finally they visited Cusco. Following a visit to the Sacred Valley of the Incas, which included collection trips to Cedrobamba and Machu Pikchu, they returned for a time to Cusco. They then continued their voyage northward, following the central sierra from Abancay and Pampas to Huancayo. From Huancayo the expedition headed to Lima via La Oroya. After collecting trips to Canta and other nearby areas, the group returned to Lima and then headed north via the Quebrada of the Fortaleza River to Huaraz, afterwhich they returned again to Lima. From Lima, the expedition continued on by air to Piura, and from there by road to Ayabaca, a locality in the extreme northern sierra of the country, where their field work in Peru was terminated. Returning to Piura, they left by ship from the port of Talara to Guayaquil, Ecuador, in the middle of May, 1959.

All of the collections from the aforementioned expedition were sent to the Max Planck Institut, situated in Vogelsang, near Colonia. Ross published his observations in a series of reports which concerned principally the ecological conditions under which the South American tuber-bearing species of *Solanum* appear to thrive and the bearing of such factors to disease resistance (Ross, 1960a and 1960b) and abiotics (Firbas and Ross, 1961 and 1962).

With regard to the classification of the above material, Ross, thinking that he had encountered some new species, proposed a number of new Latin names that were never formalized with descriptions. According to the rules of botanical nomenclature, these proposals must necessarily be treated as *nomen invalidum*. Much later, Firbas and Ross proposed *S. arraypitense* as a new wild species for northern Peru (Firbas and Ross, 1961, p. 284). However, as their description of this plant is exceedingly brief, their proposed name would again appear to fall in the category of a *nomen nudum*. Moreover, contrary to international rules, no holotype was designated.

In 1962, the Department of Botany at the University of Wisconsin and the National Science Foundation of the United States sponsored a potato collecting expedition to Mexico and South America. This expedition, headed by Donald Ugent, brought back extensive germplasm and herbarium collections of the wild and cultivated tuber-bearing species from the Andes of Ecuador, Bolivia and Peru. The itinerary for the southern part of the Peruvian journey included collecting trips to Cusco, Pisac, Urubamba, Calca, Machu Pikchu, Paucartambo, Sicuani, Puno, Juliaca and Desaguadero. Some general plant collections were also obtained along the southern coastal route from Arequipa to Lima. Collections of tuber-bearing species were obtained along the south-central route leading from Tarma to Abancay, as well as along the central routes from Lima to Huancayo and Lima to San Ramon. In the northern part of the country, a number of collections were obtained from the vicinity of Trujillo and Cajamarca. All told, Ugent spent seven months collecting in Peru, including two months in the Cusco area. He was accompanied for several weeks toward the start of the expedition by botanist Hugh Iltis of the University of Wisconsin. Several collecting trips were also made in the company of Peruvian botanists César Vargas and Ramon Ferreyra.

Germplasm collections from the above expedition are maintained at the U.S.D.A. Experimental Station at Sturgeon Bay, Wisconsin. A full set of herbarium specimens was deposited at the Herbarium of the University of Wisconsin (UW), while duplicates were sent to the Smithsonian (US), Missouri Botanical Garden (MO), Gray Herbarium (GH) and British Museum (BM). Nearly a complete set was donated to Peru, and is currently maintained in the private collection of the author (OCH).

The primary objectives of the Ugent expedition were to obtain population samples of material for biosystematic analysis, and to record the ecological conditions under which the various species grow. The aim was to try and understand the causes of variation in nature, rather than to add to the already growing and burdening list of synonyms. Some of the findings of this expedition are summarized in articles in Science (170:1161-1166, 1970), the Botanical Gazette (13:223-225, 1970) and Phytologia (48:85-95, 1981).

A number of collecting trips were also undertaken by Ugent during the years 1985-1990 in an effort to gather archaeological specimens of potatoes and other important Andean crops from desert ruins. This has resulted on a series of papers dealing with the prehistoric origins of the cultivated potato and its history of domestication along the coast. Among the several articles of interest along this line are ones which deal with the oldest known remains of the potato (Economic Botany 36:182-192, 1982; Boletin de Lima 25:28-44, 1983), distribution of the potato in ancient times (CIP Circular, 16(3):1-10, 1988), and chromatographic analysis of tuberous crop remains (1995 McGraw-Hill Yearbook of Science and Technology, N.Y., pp. 321-323).

In recent years, a classification of the cultivated potatoes of South America has appeared by Professor Vadim S. Lechnovitch of the Vavilov Institute at St. Petersburg (formerlyLeningrad). His very extensive and complex taxonomic treatment, which is based largely on species proposed by Juzepczuk and Bukasov, subdivides the group into several subspecies and numerous varieties and forms. In the Series Andigena and Subseries Tetraploidea of *S. andigenum* alone, he includes more than 75 varieties. In addition to the plants of this tetraploid subseries, Lechnovitch has proposed the Subseries Diploidea and Triploidea, wherein he groups diploid and triploid cultivars along with all of their myriad varieties and forms.

Before passing on to the author's explorations in the field of potato systematics, it needs to be pointed out that another Peruvian wild species of potato was added to the list as late as 1986, with the publication of Whalen and Sagástegui's *S. guzmanguense*.

The author's professional contributions to the field of potato systematics were made largely in two steps: the first, from 1946 to 1972, when he was employed as an agricultural technician for the government of Peru; and, secondly, from 1973 to the present, during his time of employment as a potato taxonomist at the International Potato Center (CIP).

In 1946, the author entered the service of the Minister of Agriculture as a plant breeder specializing in the improvement of wheat varieties at the Estación Experimental de Genética de Cereales at Concepción, Junín. Although the author, by that time, had already developed an interest in the native potatoes of Peru, this particular agricultural station by its very nature was not set up for genetic work dealing with the improvement of a tuber-bearing crop. These circumstances put aside, however, the author, without neglecting his official duties at that station, began to explore the surrounding regions for samples of wild and cultivated potatoes, not knowing that these efforts would later culminate in the formation of a herbarium specializing not only in the general flora of Peru, but also in a large private collection of potatoes, the cost of maintenance of which has been borne chiefly by the author.

The new species described during the author's early period of employment at the government Experimental Cereal Breeding Station, together with their geographic locations, are as follows:

Northern Peru

Department of Amazonas: *S. humectophilum* (Ochoa, 1969). Department of Ancash: *S. anamatophilum* and *S. augustii* (Ochoa, 1964d and 1974b). Department of Cajamarca: *S. acaule* var. *albicans* (=*S. albicans*), *S. cajamarquense*, *S. jaenense*, *S. chiquidenum* var. *cachicadense* and *S. chiquidenum* var. *porconense*

(Ochoa, 1959-1960), *S. contumazaense*, *S. trinitense* and *S. blanco-galdosii* (Ochoa, 1964b, 1964c and 1973). Department of La Libertad: *S. jalcae*, *S. sogarandinum*, *S. mochiquense*, *S. yamobambense*, *S. taulisense* and *S. multiinterruptum* var. *machaytambinum* (Ochoa, 1954, 1959-1960 and 1981d). Department of Lambayeque: *S. olmosense* (Ochoa, 1965b). Department of Piura: *S. raquialatum*, *S. huancabambense*, *S. ingaefolium* and *S. paucissectum* (Ochoa, 1954b and 1959-1960). Department of Huánuco: *S. ambosinum*, *S. huanucense*, *S. nubicola*, *S. ariduphilum* and *S. scabrifolium* (Ochoa, 1954a, 1962, 1970, 1972b and 1972c).

Central Peru

Department of Ayacucho: *S. ayacuchense* (Ochoa, 1959-1960). Department of Junín: *S. neohawkesii*, *S. rhombilanceolatum* and *S. neovargasii* (Ochoa, 1952 and 1962). Department of Lima: *S. cantense*, *S. chancayense*, *S. huarochiriense* (Ochoa, 1959-1960 and 1962), and *S. arahuayum* (Ochoa, 1994). Department of Pasco: *S. pascoense* (Ochoa, 1959-1960).

Southern Peru

Department of Apurímac: *S. abancayense*, *S. velardei* (Ochoa, 1963a and 1963b), *S. longiusculus*, *S. tenellum*, *S. aymaraesense* and *S. chillonanum* (Ochoa, 1987a, 1987b, 1987c and 1989a). Department of Cusco: *S. cuzcoense*, *S. sawyeri* (Ochoa, 1959-1960 and 1981c). Department of Puno: *S. tapojense* (Ochoa, 1980a). Department of Tacna: *S. acroscopicum*, *S. tacnaense* and *S. weberbaueri* var. *decurrentialatum* (Ochoa, 1953 and 1959-1960).

Wherever and whenever it was possible to ship out live specimens safely, duplicate specimens of the above collections were sent to germplasm stations in several parts of the world, where they remain to this day (Bamberg *et al.*, 1996; Hermsen and Verdenius, 1971; Vandrey *et al.*, 1994; Wilkinson *et al.*, 1994). Similarly, duplicate specimens, including type collections and isotypes, were distributed to the principal herbaria of Peru, the United States and Europe.

The collections and classifications of the native cultivated potatoes were made principally when funding was available from the National Program for Potato Breeding. The results of these efforts are to be found in a number of different publications (Ochoa, 1950, 1952b, 1953, 1955a, 1964a and 1965a), including a more recently published article that deals with the new cultivated species, *S. hygrothermicum* (Ochoa, 1984).

Other articles (Ochoa, 1951 and 1955b) published during the above period dealt with the horticultural characteristics of the several native cultivars that were used principally as a source of germplasm for the breeding of new Peruvian varieties, including the first commercial varieties that were obtained for Peru, *Mantaro* and *Renacimiento*, as well as several others (Ochoa, 1961).

By the time of his retirement from the Experimental Station at Mantaro, Junín, in 1952, the author had contributed, in all, a total of 2500 living and classified samples (E.E.M.) of native cultivars to the station, including hundreds of advanced selections of potato hybrids. Similarly, following the author's retirement from the National Agrarian University and prior to his period of employment at CIP, a total of more than 3000 classified collections of Peruvian potatoes (C.P.P) were left to that particular institution. This included an appreciable number of clonal selections, as well as numerous hybrid combinations in the form of seed.

The second stage in the author's investigation of potatoes began in 1973, when R.L. Sawyer, Director of the International Potato Center, which was founded in 1967, proposed that a conference be held to review the alarming state of genetic erosion that was occurring amongst the current day collections of the world's potato stations, as well as that which was occurring under conditions of indigenous horticulture and the wild state. Invited to this conference were scientists J.G. Hawkes, F.L. Haynes, P.R. Rowe, C.M. Ochoa, T.R. Tarn and D. Ugent. One of the major objectives of this conference was to formulate a plan for a concerted effort to gather as much germplasm as possible of the wild and cultivated species of potato before any impending extinctions could take place. Another priority of this conference was to assess the various collections that were already in storage to determine the quantity and quality of the materials available for breeding purposes. Following this first conference, which was held late in 1973, several others were held (CIP, 1976, 1979b, 1989b). From these later meetings came the principle that the Andes were to be given the highest level of priority for collection purposes, followed by the mountains of Central America and Mexico.

Today, after numerous expeditions sponsored by CIP, including a number of major ones to the Andes of South America, the Chilean archipelagoes of Chiloe and Chonos, and the Juan Fernandez Islands of Chile, the number of accessions being maintained currently by this germplasm station number well over 15,000, including some donations obtained from outside institutions and individuals. These samples, geographically, come from areas as wide spread as Chile, Argentina, Bolivia, Peru, Ecuador, Colombia, Venezuela, Guatemala and Mexico, and represent, without doubt, the largest and most complete living collections of native potato cultivars that are maintained anywhere in the world.

The following eight cultivated species are represented in the CIP collections: *S. tuberosum*, *S. stenotomum*, *S. goniocalyx*, *S. phureja*, *S.* × *ajanhuiri*, *S.*

× *chaucha*, *S.* × *juzepczukii* and *S.* × *curtilobum* (Ochoa, 1976 and 1979b; Huamán, 1986). However, given the enormous costs of the propagation of this collection and the fact that many of its accessions are duplicates, it was soon realized that a substantial reduction in cost might be achieved through the inclusion of only genetically different forms. This, then, was accomplished through the elimination of accessions that appeared to be duplicates on the basis of similar morphology and genetic constitution. As a check on the foregoing, the plants were subjected to electrophoretic analysis in the laboratory of Professor Hermann Stegemann of the Institut für Biochemie, Biologische Bundesantald at Braunschweig, Germany (*cf.* Ochoa, 1979b; Huamán, 1986; Huamán and Stegemann, 1989). Today, as a result of these efforts, the number of different genotypes maintained at CIP have been reduced to about 3500. Each of these accessions are maintained in three ways, by tuber, by seed and by tissue culture (Huamán, 1986 and 1987).

Although a lower priority is given to the maintenance of the wild potato species at CIP (and especially of the wild forms from Peru), the collection nevertheless includes some 1500 samples, these originating principally from Peru, Bolivia, Mexico, Ecuador and Uruguay, but including some samples from Paraguay, Colombia, Chile, Venezuela, Brazil and the United States as well (Ochoa, 1979b; Ochoa and Schmiediche, 1987; Huamán, 1994).

Unfortunately, the thousand or so Peruvian samples of wild potato that are included in the above collections represent, in reality, but a small portion of the genetic diversity that actually exists in nature. Moreover, no more than about 50% of the known species of Peru are currently included in the collections, which, by the way, are carefully supervised by Alberto Salas of the Department of Genetic Resources.

The following new taxa were discovered during my second stage of my potato investigations as the result of expeditions sponsored by CIP:

Northern Peru

Department of Amazonas: *S. burkartii* (Ochoa, 1977). Department of Ancash: *S. peloquinianum* (Ochoa, 1980b). Department of Cajamarca: *S. lopez-camarenae* (Ochoa, 1974a) and *S. irosinum* (Ochoa, 1981b). Department of Lambayeque: *S. incahuasinum* (Ochoa, 1979c). Department of Huánuco: *S. salasianum* (Ochoa, 1989c).

Central Peru

Department of Ayacucho: *S. sarasarae* (Ochoa, 1988b). Department of Huancavelica: *S. bill-hookeri* and *S. amayanum* (Ochoa, 1988a and 1989b). Department of Junín: *S. antacochense* (Ochoa, 1981a). Department of Lima: *S. chrysoflorum*, *S. hapalosum* and *S. simplicissimum* (Ochoa, 1982, 1983c and 1989d).

Southern Peru

Department of Cusco: *S. incasicum* (Ochoa, 1981d). Department of Puno. *S. limbaniense* (Ochoa, 1974c) *S. saxatilis* (Ochoa, 1992), and *S. tarapatanum* (Ochoa, 1977b).

In addition to the above species, three new species (*S. ancoripae*, *S. huacavelicae* and *S. puchupuchense*) appear in the present work.

Although numerous wild species of potato have been described previously for the flora of Peru, in the author's opinion, there are only 90 that appear to be taxonomically legitimate. Part 2 of this work will contain a revised classification for the cultivated species of this group.

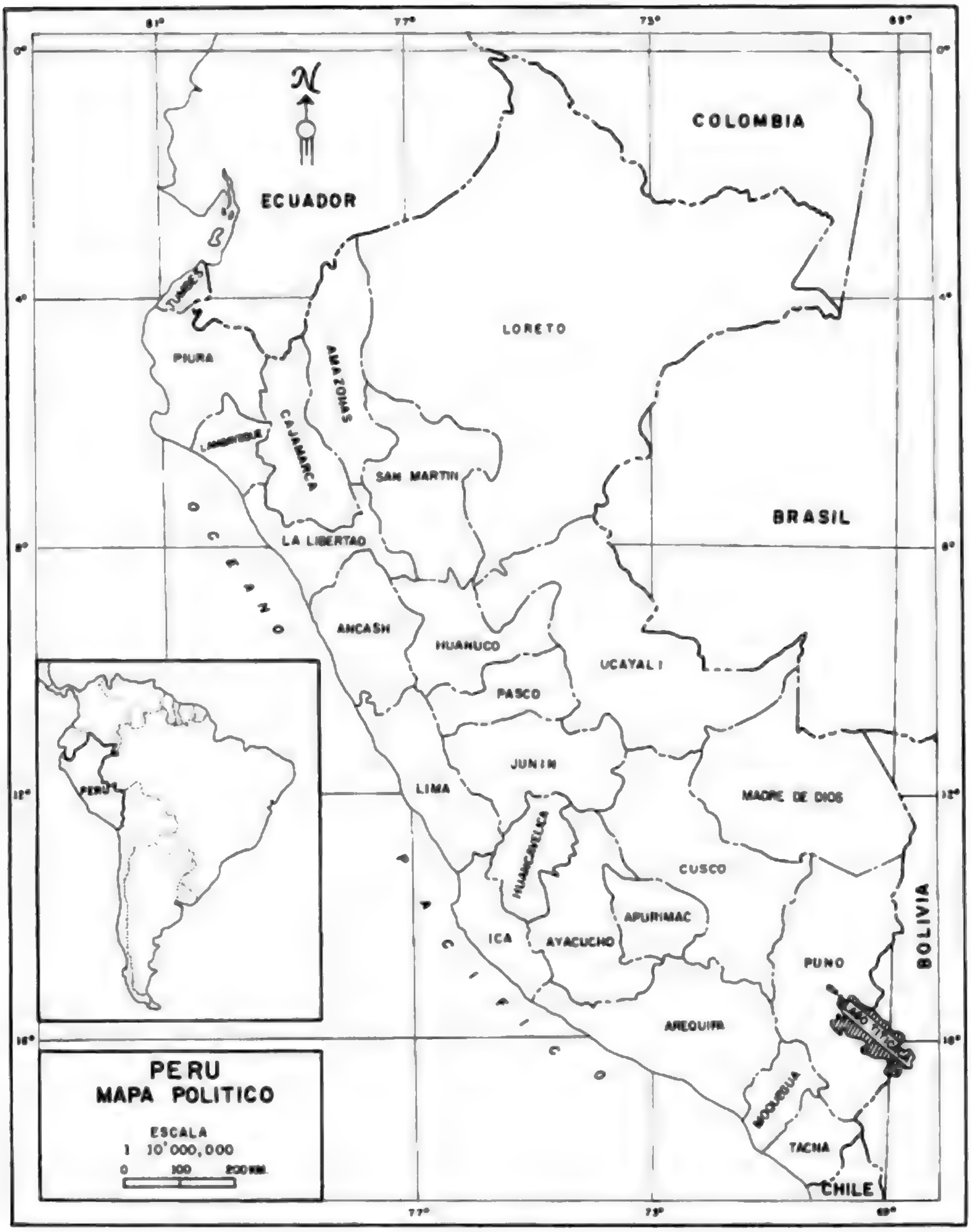
And finally, it needs to be mentioned that the author's general plant collections of the flora of Peru, assembled during several decades of work, were donated some time ago to the Herbarium of the Universidad Nacional Agraria at La Molina (MOL). In the near future, it is expected that the various collections of tuber-bearing species of *Solanum* will also be donated to a public institution.

GEOGRAPHY AND CLIMATE

Peru is situated in the northwestern part of South America. It has an area of 1,285,216 km^2 and a population of 22,640,000 inhabitants, according to the 1993 census. Its extreme northern-most territorial point lies at 00°01'48" S and 75°10'29" W, while its southern-most boundary falls at 18°20'50" S and 70°22'31" W. Longitudinally, the borders range from 12°30'11" S and 68°39'27" W in the eastern portion of the country to 04°40'44" S and 81°19'34" in the west (Instituto Geográfico Nacional, 1989). It is bounded on the north by Ecuador and Colombia, on the east and southeast by Brazil and Bolivia, on the South by Chile and by the Pacific Ocean on the west (Map 1). A third of the population lives in Lima, the capital of Peru.

Good air transportation and land routes connect the cities of the coast and the principal interior mountain centers of production. Callao, the principal sea port of Peru, links the country to the rest of the world. The southern part of the country is served by rail lines and asphalt roads, and there is boat service across Lake Titicaca. These services in the southern part of the country have helped to foster an intense interchange of tourists and commercial goods between Peru, Bolivia and Chile. And, in the forested *selva* region of the country, amphibian planes are used to provide services to isolated river ports and landing strips. However, there are still many other remote places of the country that remain unreachable by modern means of transportation.

For the past several centuries, Peru has been popularly recognized as being comprised of three major geographical regions: the Coast, limited by the Pacific Ocean; the Sierra, as represented by the Andes Mountains; and, the Montaña or forest region. Recently, with the passage of a bill extending the country's sovereignty to a distance of 200 miles off-shore, an additional Ocean Territory or *Mar*



Map 1. Political divisions of Peru
(Atlas del Perú, p. 85, Lima 1989).

de Grau has been recognized. Characterized by its extraordinary ichthyological diversity, this area is considered to be one of the richest fishing grounds in the world.

While the above simplified system of classification is useful for some purposes, modern geographical systems generally treat the country as being much more diverse with respect to its topography, climate, fauna and vegetation. In fact, probably not many places in the world, if any, illustrate as many extremes in climate, topography, biota and ecology as Peru. From its extensive deserts that run parallel to the Pacific Ocean along the western shoreline of South America to its immense tropical forests that stretch eastward from the Andes Mountains to the Amazon basin, one runs into extremely varied geographic and floristic formations.

The above regions have been variously treated by different authors as biogeographical provinces, as for example, Cabrera and Willink's (1973) five divisions (*Puneña*, *Alto Andina*, *Yunga*, *Prepuna* and *Amazonía*), or as eco-regions, as in the case of Ellenberg's (1959) classification (semi-moist or semi-arid puna, semi-moist or semi-arid valleys and montañas, moist montane forest and semi-moist lowland forests).

Holdridge, on the other hand, has implemented an ecological scheme of classification for Peru that makes use of some 84 clearly differentiated life zones (Holdridge, 1967, 1978; Tosi, 1960). Later investigators have expanded the system to include over 100 life zones (*cf.* ONERN, 1976).

Ecologists have also pointed out that the transitional zones that connect the different climatic and ecological regions of Peru are fairly narrow, occurring over rather short distances or altitudinal levels (Knoch, 1930; Koppen, 1931).

The tremendous variations that one encounters in the climate and physiography of Peru have probably had a great deal to do with the richness and diversity of its flora and fauna. The complexity of its vegetative formations have been extensively studied by Weberbauer (1945) and by many other authors (Herrera, 1930-1933, 1939; Vargas, 1946; Ferreyra, 1969; Peñaherrera, 1969; Malleuk, 1975; Hueck, 1978). According to one recently published nomenclatorial work dealing with the ferns, gymnosperms and angiosperms of Peru (Brako and Zarucchi, 1993), over 17 thousand species have been collected within the boundaries of this country. Similarly, with regard to the faunal richness of Peru, and especially with regard to the diversity of its bird and insect life (two areas, however, which are far from being exhausted as far as their further study is concerned), this country ranks as one of the more important places of the world (Peñaherrera, 1969; Brack, 1969-1972, 1976; Dourojeanni y Ponce, 1978; Velásquez, 1993).

The climate of Peru, as noted earlier, is as diverse as its topography and biota. This is due principally to the rain-shadow effects of the Andean Mountain chain and the cold oceanic currents with their anticyclonic movements in the southern Pacific. Thus, the climate varies from tropical in the case of the warm and humid Amazonian forest region or *selva*, to glacial, as in the case of the cold, dry *punas* and snow-covered peaks. According to Koppen (1931), the following climatic regions exist for Peru (see Map 3): Tropical Forest (*Af*), an area hot and rainy throughout the year; Savanna Land (*Aw*) with moist summers and dry winters; Steppe Lands, these with either rainy winters (Bss) or moist summers (*Bsw*); Desert Lands (BW), with little rain; Moderately Temperate-moist regions (Cw), these having dry winters, with 10 times as much precipitation falling during the wettest month of the year as during the driest; Cold Boreal climate (Dwb), dry in winter with an average high temperature of 10° C or less during the 4 month-long growing season; High, Dry Mountain Tundra (ETH), where the average temperature of the warmest month is above 0° C ; and, the very high regions of Perpetual Snow (EFG), where the average monthly temperature throughout the year is less than 0° C.

As a result of the many scientific studies that have been made during the past few decades, we now have much greater knowledge of the geography of Peru. Certainly, a system of classification that breaks down this huge diverse territory into many natural regions based upon topographic relief, climate, vegetative composition and native fauna gives us a clearer and more realistic picture of the geography of this land. Another example of this will be found in Pulgar Vidal's work "Geografía del Perú." Pulgar, who has defined eight natural regions of the country, uses names taken from the Quechua language (*Runa Simi*) to distinguish his regions.

In the present work, the geography of Peru is treated under the following divisions:

The Coast (or *Chala* following Pulgar Vidal)

This region is characterized by a long narrow strip of desert, some 2500 km in length but only 150 km wide on the average. It extends from this country's southern border with Chile to its northern border with Ecuador. Altitudinally, this very arid region ranges from sea level to about 500 m elevation. Precipitation averages 80 mm or less during the year. Minimal temperatures vary from 18° C along the southern coast to about 19°C along the central coast. Temperatures increase as one goes inland a short distance from the coast but then decrease again as one climbs upward in elevation. Ecologically, this part of the coast falls under Tosi's (1960) life zone classification of d-ST, or, if one follows ONERN (1976), it would be classified under either Premontane Tropical dry desert, dd-PT or Dry Subtropical Desert, Dd-S.

Many seasonally dry river beds and irregularly-flowing streams cut across the desert coast from east to west. Despite the general scarcity of water, these streams have been used for agricultural production since very ancient times, and, indeed, still remain as the principal source of water for the growing of crops in modern day Peru.

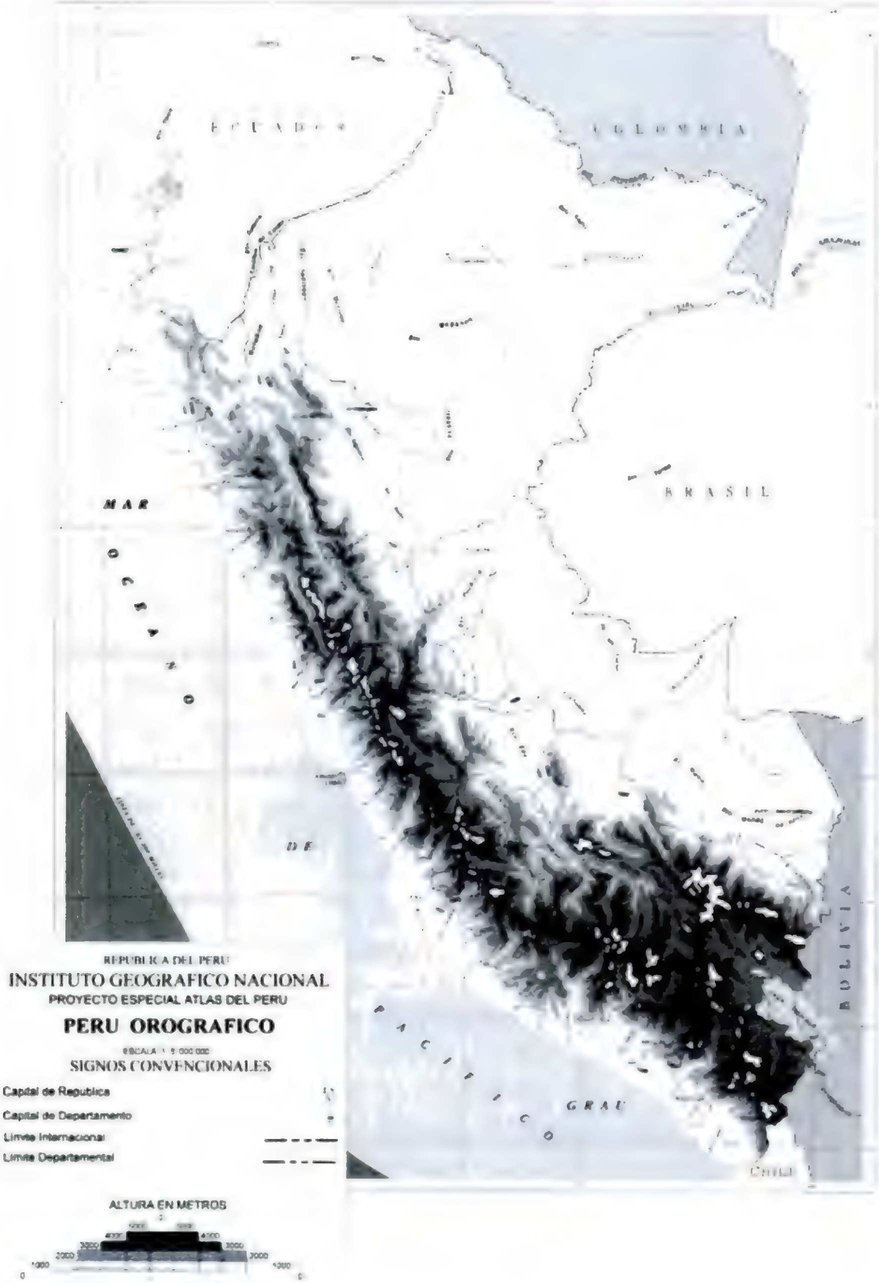
With regard to the natural vegetation of this coastal area, relatively few species dominate the scene, including *grama salada* (*Distichlis* sp.) along the shoreline, *carrizo* (*Phragmitis communis*) on the alluvial plains and river banks, *algarrobo* (*Prosopis limensis*) along the northern coast, *faique* (*Acacia macracantha*) in the deserts of Pisco and Ica and mangroves (*Rhizophora mangle*) in the vicinity of Tumbes along the extreme north coast. Here and there throughout the desert region one finds occasional genera of the cactus family, such as *Opuntia*, *Mila*, *Haageocereus* or *Islaya*.

Moreover, this coastal area is known for its very special seasonal plant formation called the *Lomas*, which have a rather unique floral composition (Aguilar, 1973; Ferreyra, 1953, 1957, 1961). These *lomal* formations owe their development to the clouds that drift inward from the Pacific Ocean and which deposit their water in the form of a fine mist (or *garúa*) upon the land. These clouds in turn develop over the cold Antarctic current that sweeps the coast from south to north, and the little moisture that is held within them condenses when they pass over the first foothills of the Andes. Because of the little moisture that falls upon the *lomas*, they are not very rich floristically. All told, probably no more than about 150 plant species grow in these special habitats (Brako and Zarucchi, 1993). Two of these endemic plant species, however, are the wild potatoes *S. chacayense* and *S.* × *neoweberbaueri*.

About 70 loma formations are known from the coast of Peru. These extend from Cerro Campana, Cabras and Combo near Trujillo (*ca.* 08° S Latitude) to Morro de Sama in the Department of Tacna (or 18° S). Among the most important of these because of their size and floristic diversity are the coastal lomas of Atiquipa, Chala and Islay in the Department of Arequipa. Unfortunately, the lomas of this department (as in the case of the other departments where lomas occur) are in serious danger of extinction due to overgrazing, urban expansion and pollution.

Yunga Regions

The term *Yunga* is used mostly in reference to low-elevation mountain areas that fall between 500 and 2300 m altitude. According to Pulgar Vidal (1987), there are two kinds of *yunga* formations, *Yunga Marítima* and *Yunga Fluvia*. The *Yunga Marítima* region comprises the valleys that descend to the Pacific Ocean from the western slopes of the Andes Mountains, while the *Yunga Fluvia* area takes in the



Map 2. Orographic map of Peru
(Atlas del Perú, p. 125, Lima 1989).

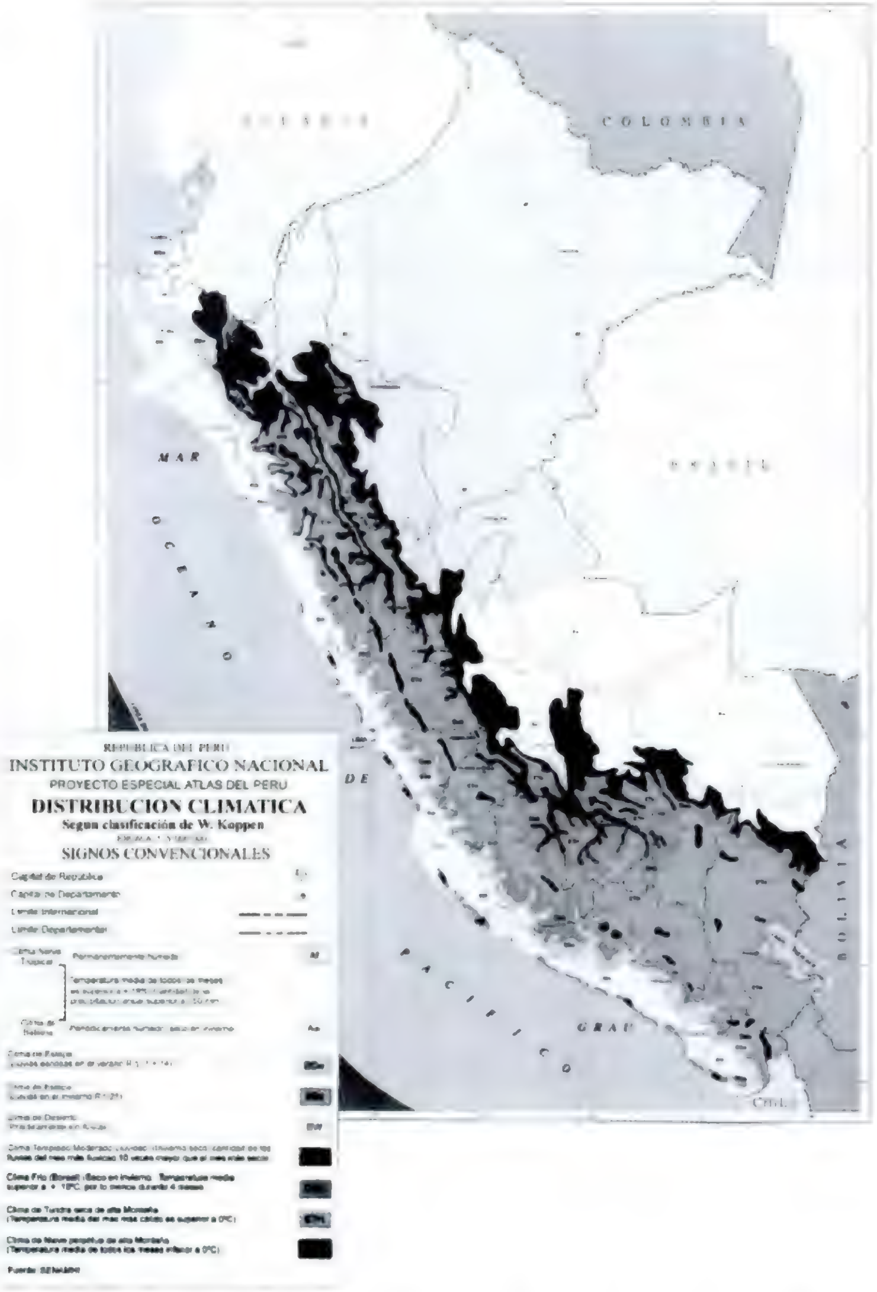
valleys of the eastern mountain slopes that descend toward the Atlantic Ocean. The climate of the *Yunga Marítima* region is arid and desert-like with very little seasonal precipitation. Temperatures in the *Yunga Marítima* are warmer than in the *Fluvial* region, about 20-27° during the day, and somewhat cooler at night. Precipitation in the *Fluvial* region, on the other hand, is higher than in the *Yunga Marítima*, 400-1000 mm during the summer months (January-March), but air temperatures are often lower. On the lower slopes of the *Yunga Marítima* the vegetation is only poorly developed. Here may be found some bulbous plants and cacti, as well as the wild potato species *S. immite* and *S. wittmackii*. Other species commonly encountered in this region are the *molle* tree (*Schinus molle*), the *cabuya* (and especially the *cabuya blanca*, or *Furcraea occidentalis*), and several native fruit trees including *guayabo* (*Psidium guajaba*), *lúcumo* (*Pouteria lucuma*), *guanábana* (*Annona muricata*) and *ciruela de fraile* (*Bunchosia armeniaca*).

Sierra

A short distance from the coast one encounters the first foothills of the great Andean mountain chain or *cordillera* that passes across the territory of Peru from north to south. This region, more commonly known as the *Sierra*, forms a spectacular backdrop to the arid desert plain of the western coast and the luxuriant vegetation of the Amazonian forest to the east (Map 2). Thus, geographically speaking, the coast and the forest region or *selva* are separated by a giant chain of mountain peaks that vary in altitude from about 1100 m to 6768 m, the latter being the height of Peru's tallest peak, El Huascarán. The Andes in this part of the continent consist of some 170 peaks that are above 5000 m in altitude and 39 peaks that tower more than 6000 m. Associated with these high mountains are numerous deep valleys and quebradas, as well as some high open grassy slopes that are called *punas* in central and southern Peru and *jalcas* or *páramos* in the north. Usually, these vegetative formations are encountered between 3500 and 4500 m altitude. The maximum average temperature in the *puna* formation is about 14° C. During the rainy season (September through October), the precipitation in the *puna* is much greater than that which falls on the coast, about 550-650 mm, and the relative humidity ranges about 78%. For *jalca* regions, the temperature is about the same as the *puna*, but the precipitation is greater, about 945 mm.

Quechua Region

This region is situated on both the eastern and western slopes of the Andes at altitudes between 2300 and 3500 m (Pulgar Vidal, 1987). The valleys and mountain crests of this region divide the territory into Atlantic and Pacific watersheds.



Map 3. Climatic distribution map of Peru, according to Köppen's classification (Atlas del Perú, p. 119, Lima 1989).

The climate of the area is temperate, but with notable night and day extremes in temperature. The greater part of the precipitation in this region falls during the summer months, and is occasionally very abundant. However, there is little or no rainfall during the long winter season. The vegetation of this region is variable in composition, but consists of both herbs and woody plants. Among the native trees are *aliso* (*Alnus jorullensis*), *quiswar* (*Buddleja* sp.) and *chachacomo* (*Escallonia resinosa*). Indigenously cultivated plants of the lower temperate valleys of this area include papaya (*Carica* sp.), *granadilla* (*Passiflora* sp.), *caigua* (*Cyclanthera pedata*), *chayote* (*Sechium edulis*), *calabazas* (*Cucurbita* sp.), tree tomatoes (*Cyphomandra betácea*), tomato (*Lycopersicon esculentum*) and, above all, maize (*Zea mays*). Root crops are represented by *arracacha* or *virraca* (*Arracacia xanthorrhiza*), *llacón* (*Smallanthus sonchifolius*) and potato (*Solanum tuberosum*), the latter cultivated at the upper arable elevations. And finally, within this Quechua region are found the largest number of tuber-bearing species of *Solanum*, or wild potatoes.

Suni Region

According to Pulgar Vidal (1987), the *jalca* plant formations that were mentioned earlier are to be classified under this division. He also reports that the name of this region was derived from a word in the Quechua language meaning "high." Indeed, the various territories that are represented on both sides of the Andes by this geographic division are situated at elevations between 3500 and 4100 m altitude. Included within this region are very narrow valleys and steep escarpments, as well as gently rolling areas that vary from undulating to nearly plane. Examples of the latter include the table-like *altiplano* that occurs in the vicinity of Lake Titicaca, the extensive grasslands of the Pampas de Canas and Espinar in the southerly Department of Cusco, and the *pampas* of Junín, in the central portion of the country. Climatically, this region is cold and dry. The average annual temperature of the *Suni* region varies between 7° and 10° C. Whereas the maximum recorded high is 20° C, the minimum temperature for the winter months of May through August ranges from 1° C to -16° C. As might well be expected from a high mountain region were the atmosphere is crystal clear, there are marked temperature differences that occur between day and night.

The flora of the *Suni* region is comprised of various species of woody and herbaceous plants, including grasses and composites; several frost resistant species of wild potatoes (or *apharu*) such as *Solanum acaule* and *S. bukasovii*; woody shrubs such as *chinchercoma* (*Mutisia acuminata*), *taya* (*Baccharis* sp.) and *cantua*, the national flower of Peru (*Cantua buxifolia*); and the *kkewiña* tree (*Polylepis racemosa*). Cultigens native to this Andean region include *tarwi* (*Lupinus mutabilis*), *quinoa* (*Chenopodium quinoa*), *kkañiwa* (*Chenopodium pallidicaule*), and several root crop species such as *oka* (*Oxalis tuberosa*), *olluco* (*Ullucus tuberosus*) and *mashua* or *isaño* (*Tropaeolum tuberosum*). Several species of cultivated potatoes are also grown in this region, including *Solanum tuberosum*, *S. stenotomum* and *S. goniocalyx*, among others.

Puna Region

The name for this high altitude (4100-4800 m) Andean region, derived from the Quechua according to Pulgar Vidal (1987), is in reference to "high mountain crests." The average width of the region is more than 100 km in the extreme south, but narrows to only a few km in the north. The climate is cold, usually above zero during the day and below zero at night, with a marked difference in the diurnal temperatures. The annual mean temperature is above 0° C, but climbs to 15° C between September and April, with occasional extremes to 22° C. From May through August, absolute temperature lows varying between 9° C and 25° C have been recorded. As far as the habitat of this region is concerned, it belongs principally to such grazing animals as the vicuña (*Lama vicugna*) and the alpaca (*Lama pacos*). The flora of this area is not very diverse. A few species of gramineae form occasionally large grasslands, these dominated by *ichu* (*Stipa ichu*) and *ocsa* (*Festuca* sp.). Other dominant plants of this region include *quisca* (*Lobivia* sp.), *huarakko* (*Opuntia floccosa*), *huamanpinta* shrubs (*Chuquiraga* sp.), lupines (*Lupinus* sp.) and *tola* (*Lepidophyllum quadrangulare*). In the *punas* of Ancash, Lima and Junín, one comes across relic stands of *ticana* (*Puya raimondi*), a giant bromeliad some 8-10 m tall that is on the road to extinction, as well as some relic populations of *kkewiña* (*Polylepis* sp.). With regard to cultivated species, several highly frost resistant native potatoes by the name of *shiri*, *waña* and *rucki* (*Solanum juzepczukii* and *S. curtilobum*) are grown at the lower altitudinal limits (4100-4300 m) of the *Puna* region in central and southern Peru. Finally, the edible root crop species called *maca* (*Lepidium meyenii*), is grown in small plots at the upper limits (4500-4700 m) of this zone in the Puna de Junín. As in the case of several other native food plants, it may not be long before the cultivation of this species is completely abandoned.

Janca Region

This geographical region, according to Pulgar Vidal (1987), corresponds to the highest and coldest Andean mountain crests that are covered with perpetual snow, appearing whitish as alluded to by its native name. Altitudinally, this region extends from 4800 m up to 6768 m, which represents the top of Peru's highest peak, El Huascarán. The climate is inhospitable and totally unfavorable for human life. In the lower elevations of this zone there occurs some plant life, mostly grasses and composites, but also *yareta* (*Azorella* sp.). The latter species may be found as high as 5000 m elevation, but is much more common and widely distributed in the *Suni* zone. Unfortunately, the *yaretales* are becoming very rare as they are being harvested for use as fuel. The *janca* is also the domain of the condor (*Vultur gryphus*), a very large bird of the high Andes that has a wingspan of over 4 m.

Ceja de Selva

This region is situated at elevations between 1500 and 3600 m on the eastern slopes of the Andes Mountains. The *Ceja de Selva* corresponds, with some variations in altitude, with Pulgar Vidal's geographic division of *Rupa-Rupa*. The difference, however, lies in the fact that the climate of the *Sierra* is subtropical or tropical-moist, and the forest stands are either more or less open or densely structured depending upon the elevations in which they occur. During the nine months of the rainy season (August-April), the precipitation of this region surpasses 2000 mm, but is much less or even rare during the rest of the year. One example of such a region is the Urubamba Canyon in southern Peru (alt. 2400-2600 m), this being the home of two wild potato species, *Solanum santolallae* and *S. urubambae*. Here, the relative humidity is not uncommonly 90%, while the maximum temperature rarely exceeds 21.5° C. The *Ceja de Selva* comprises mountain chains and open valleys that extend broadly across the eastern slopes of the Andes. Included within this area are hills with rounded tops and in some places escarpments. The rivers that flow through this area form narrow canyons called *pongos* or *puncos*, Quechuan names that refer to doors that open in a particular direction, in this case, the doors that provide entrance to the plains of the Amazon.

Selva Alta

The vegetation of this region, which is also known as the *Ceja de Montaña*, is abundant and varied. Within this geographic region are found a number of species of great economic value, including the *caucho* tree (*Castilloa elastica*) and various palm species, including *yarina* (*Phytelephas macrocarpa*), *huicungo* (*Astrocaryum huicungo*) *chonta* (*Bactris gasipaes*) and *bombonaje* (*Carludovica palmata*). A rare species of potato, *Solanum hygrothermicum*, grown by some of the forest dwellers of this humid tropical region, is known from the lower slopes (1000-1500 m) of the *Selva Alta*.

Selva Baja

This lowland region (alt. 80-400 m) is also called *Amazonía* or *Omagua* in Pulgar Vidal's scheme of classification. For the most part, this forested area shows very little relief, although in some places there are gently sloping hills, but never of great elevation. Because of the past flooding of the *selva baja*, there are places in this region where the rivers have formed large marshy areas called *Tahuampales*. Together, the many rivers and tributaries of this area form a vast watershed. It should be noted that these watercourses, which carry a huge volume of water, are technically part of the great Amazon river basin system. Floristically, the vegetation of the selva baja is very abundant and diverse (Weberbauer, 1947; Malleux, 1975; Hueck, 1978). Many economically important species are known from this region, including the *aguaje* palm (*Mauritia flexuosa*), rubber trees (*Hevea brasiliensis* and *H. pauciflora*), the mahogany tree (*Swietenia mahagoni*) and the *ayahuasca* vine (*Banisteriopsis caapi*), the stems of which are used in the manufacture of an hallucinogenic beverage.

SYSTEMATIC TREATMENT AND GENETIC POTENTIAL OF THE TUBEROUS PERUVIAN SPECIES

The genus *Solanum* L. (Linnaeus, 1753) is highly polymorphic and very complex. Moreover, it is the most important genus of its family, the Solanaceae. Although occurring on every continent of the world, the various members of this genus grow preferentially in the tropical and subtropical zones. Many species of this genus are known from both the American tropics and the temperate regions of the world. Most are unarmed and herbaceous or shrubby, although they may be occasionally armed with spines. Some produce edible fruits; others poisonous fruits; and, still others produce subterranean stems or tubers as in the case of the species treated here.

Many authors have attempted a classification of the tuberous species of this genus (Dumortier, 1827; Dunal, 1852; Bitter, 1912-1924; Rydberg, 1924; Juzepczuk and Bukasov, 1929-1937; Bukasov, 1933, 1955, 1971a, 1971b, 1978; Hawkes, 1944, 1963, 1966, 1978, 1989, 1990; Brücher, 1954, 1957, 1962, 1964-1966; Hawkes and Hjerting, 1969, 1989; Vargas, 1949, 1956; Correll, 1952, 1962, 1967; Seithe, 1962; Bukasov and Kameraz, 1959; Matsubayashi, 1961b; Montalvo and Sanz, 1962; D'Arcy, 1972; Ochoa, 1955, 1962, 1972, 1975, 1979a, 1990; Flores Crespo, 1966; Gorbatenko, 1989; Spooner and van den Berg, 1992). However, at the present time, no two systems are precisely alike and many problems in classification wait to be resolved.

Dunal (1852) divided the genus *Solanum* in two sections, Pachystemonum and Leptostemonum. Pachystemonum was then subdivided by him into the following five subsections: Tuberarium (which includes the potato and its relatives), Morella, Dulcamara, Micranthes and Lycianthes. Toward the beginning of the twentieth century, Bitter (1912) elevated the sections Pachystemonum and Leptostemonum to the rank of subgenera. In so doing, his subsections then became sections. Following this, Bitter subdivided his new Section Tuberarium into two new subsections, Basarthrum and Hyperbasarthrum. In his subsection Basarthrum he included all non tuber-bearing and non-stoloniferous plants that had pedicels articulated at the base, slender woody stems and bicellular, bayonet type hairs (the latter consisting of an enlarged basal cell and a more slender and pointed apical cell). In contrast, while the plants of his subsection Hyperbasarthrum were mostly of the stoloniferous and tuber-bearing variety, these species had pedicels that were articulated at some distance above the base and hairs (when present) that were either simple or multicellular.

Subsection Hyperbasarthrum was also subdivided by Bitter (1912) into taxonomic groups called "series." These were considered by him to rank as one step above the level of species. This was the classification that was later to be followed by Rydberg (1924) and others.

Unfortunately, the name designated and so long followed for this group, Section Tuberarium Bitter, is antedated by the Section Petota of Dumortier (1827). According to D'Arcy (1972), this older name for the tuber-bearing species and their close relatives has to be followed for reasons of conservation and priority (see Art. 29 and 30 of the ICBN, Tokyo Code, 1994). Moreover, Subsection Hyperbasarthrum, as it happens to turn out, is a synonym of the Subsection Potatoe, which was proposed by G. Don in 1838.

The most recent treatment of the genus by D'Arcy (1979 and 1991) divides the group into the following seven subgenera: *Archaesolanum*, *Bassovia*, *Brevantherum*, *Leptostemonum*, *Lyciosolanum*, *Potatoe* and *Solanum*. Each is then subdivided into sections, subsections and series (D'Arcy, 1972). All in all, D'Arcy estimates the genus *Solanum* may contain as many as 1000 to 1400 species.

In the present work, the wild tuber-bearing species are treated as members of the Section Petota Dumortier of the Subgenus Potatoe (G. Don) D'Arcy. This section is also important economically as it includes the cultivated potato, *S. tuberosum* L.

Recently, Professor Hawkes (1989) has proposed the division of Section Petota into two Subsections, Estolonifera Hawkes and Potatoe G. Don. The Subsection Estolonfera is comprised of non-stoloniferous and non tuber-bearing species of *Solanum* that vegetatively resemble the true potatoes and which were formerly classified in the Series Etuberosa and Juglandifolia. The Subsection Potatoe, on the other hand, which includes the potato and its wild relatives, is subdivided by Hawkes into two large groups or superseries on the basis of corolla shape. He includes nine series in his group Stellata, which is characterized by plants having star-shaped corollas, and ten series in his group Rotata, in which the flowers of the plants are wheel-shaped. However, it is of some interest here to note that a word similar to Stellata was used earlier by Bukasov (1971, pp. 35-37), who grouped the wild stellate-flowered species of North and Central America into a subsection called Stellatum. North and Central American plants with rotate or rotate-pentagonal flowers, however, were placed by Bukasov in his subsection, Arcticum (Bukasov, 1971, pp. 32-35).

According to Hawkes (1990), the system of classification of the series that he uses comprises an evolutionary sequence. Within each series, the plants are more closely related to one another than to those which occur in adjacent series. His treatment is based not only on inspiration and theory, but also on results obtained from serological, morphological and cytological studies, as well as on investigations dealing with the numerical endosperm balance. The results of his studies suggest that the most primitive species of the Superseries Stellata are those which are currently classified in the Series Morelliformia, Bulbocastana, Pinnatisecta and Polyadenia. All have a numerical endosperm value of one, and all have ranges that fall in either central or southern Mexico or in northern Guatemala. Hawkes theorizes that this mountainous district may have been the original center of origin for the wild species of potato, which at a much later date then migrated south along the Andes until some members of this stellate group finally reached Peru, Bolivia and Argentina. There, plants having rotate corollas evolved from stellate-flowered forms, the latter representing, possibly, the ancestral species of the present day Series Circaeifolia, Commersoniana and Yungasensa. Today, we find the most primitive species of the Superseries Rotata in the Series Cuneoalata and Megistacroloba and partly within the Series Conicibaccata, Tuberosa and Acaulia. Following this southward migration of species, a return migration of species to the original Mexican center of evolution occurred, according to Hawkes, and this was followed shortly by the establishment of two polyploid series, Longipedicellata and Demissa, the flowers of which are normally very broadly rounded or rotate.

More recently, Hawkes and Jackson (1992), using the same taxonomic elements as mentioned before, re-analyzed the Superseries Stellata and Rotata. Extreme importance was given this time not only to the shape of the corolla but also to its white color. Moreover, the geographical patterns of distribution of the various species were also emphasized. They concluded that their data for the most part supported an original Mexican center of origin for the wild species.

Unfortunately, while the above evolutionary scheme of Professor Hawkes looks good in theory, in practice there are actually many difficulties involved in applying it satisfactorily to the various taxa. For one thing, while the extremes in corolla shape can be easily distinguished from one another, it just so happens that in nature there occur many intermediate shapes. In flowers that are clearly stellate, the petals are deeply lobed and the principal radius (i.e., the distance from the center of the corolla to the tip of the acumen) is much longer than the distance from the center of the flower to the connection point between the petals. In flowers that are clearly rotate, however, the sinuses are filled with interpetalar tissue and the principal radius nearly equals the length of the connecting tissue. Many species which show only partial development of the interpetalar tissue, can be classified only arbitrarily in one category or the other.

Along with characteristics of the corolla, the above theory also suggests that it is important to take into account the values of the numerical endosperm balance of the various species. Here, the evidence turns out to be contradictory for the Peruvian wild diploid species of potato. In the case of *S. yungasense* of the Series Yungasensa, for example, the flowers are white and deeply stellate and yet the numerical endosperm balance of this species has a value of 2. Still another species from southern Peru, *S. lignicaule* of the Series Lignicaulia, although having a numerical endosperm balance of 1, has a rotate-pentagonal or broadly substellate corolla with prominent lobes and acumens. Moreover, in the latter species, the corolla is yellowish-white or occasionally cream-colored and the acumens and the upper borders of the lobes are light purple (Figs. 121-122). Again, the species *S. chiquidenum* (Series Piurana) from northern Peru has yellowish-white, rotate-pentagonal flowers (Figs. 176 and 182) and a numerical endosperm balance of 2. However, its var. *gracile*, which also has a numerical endosperm balance of 2, has a substellate or deeply stellate flower (Fig. 180). Furthermore, a great many of the wild Peruvian diploid species in which the corolla is both rotate and white also have a numerical endosperm balance of 1, including *S. cajamarquense*, *S. chancayense*, *S. immite*, *S. incahuasinum*, *S. mochiquense* and *S. trinitense* of the Series Tuberosa; *S. raquialatum* of the Series Ingaefolia; *S. guzmanguense* and *S. simplicissimum* of the Series Simplicissima; and *S. hypacrarthrum* of the Series Piurana. In addition, it is also worth mentioning that there are several diploid species in Peru that have a rotate, pigmented corolla and a numerical endosperm balance of 1, including *S. augusti*, *S. lopez-camarenae* and *S. wittmackii* of the Series Tuberosa, and *S. ingaefolium* of the Series Ingaefolia.

Series Juglandifolia, which consists of shrubs and lianas with woody stems and a single herbaceous species, has been excluded from this work. The four species of this series are *S. juglandifolium* Dun., of Central America, Colombia and Ecuador; *S. ochranthrum* Dun., of Colombia, Ecuador and Peru; *S. lycopersicoides* Dun., a Peruvian species; and, *S. sitiens* Johnston, a non-woody species endemic to northern Chile. None of the species are stoloniferous or tuber-bearing, and all have yellow flowers. These appear to be more related to the genus *Lycopersicon* than to the tuberous species of the genus *Solanum*.

Another yellow-flowered species omitted from this work is *S. pennellii* Corr. This species bears leaves similar in appearance to those found in the genus *Lycopersicon*, but the anthers are more like those of the genus *Solanum*. Correll (1962, p.39) placed this species in a new and separate section of *Solanum*, which he termed *Neolycopersicon*. Rick (1960) reports that the single species of this section crosses much more easily with plants of the tomato genus than with species of tuber-bearing *Solanum*.

Although many attempts have been made to classify the tuberous species of *Solanum*, there has been little agreement amongst authorities as to how to construct and arrange the higher groupings of Section Petota (this itself formerly known as Section Tuberarium). Ranging from the time of Dunal (1852) and Bitter (1912-1924) all the way up to the modern era, numerous subdivisions or treatments of this tuberous group of species have been proposed. Some have taken the species and ordered them into series and subseries on the basis of morphological and eco-geographic considerations (Bukasov, 1959, 1971; Bukasov and Turuleva, 1982; and Gorbatenko, 1982, 1989), while others have attempted to arrange them into series and superseries on the basis of their morphology, distribution and evolutionary aspects (Hawkes, 1956, 1958, 1989 and 1990).

Because of the lack of sufficient material for study or perhaps because of the inconsistencies inherent in the taxonomic proposals, it is often impossible to make a clear distinction between taxonomic series. This has often led in the past to inaccuracies in the identification of the various taxa or to errors in the determination of their series. Despite this, there is no uniform consensus amongst potato taxonomists today as to what constitutes the limits of a series, nor is there universal agreement amongst potato workers as to the definition of a species. Thus, according to Bukasov (1959), it would be incorrect to include members of Series Oxycarpa Rydberg within the Series Conicibaccata Bitter; whereas, Correll (1952) and Hawkes (1956) consider the former series to be wholly synonymous with the latter. Similarly, Correll's Series Trifida has not recognized by either Bukasov or by Hawkes, but is treated rather as a synonym of Rydberg's Series Pinnatisecta. Another example concerns Bukasov's Series Demissa and Longipedicellata, which are recognized by Hawkes but not by Correll, who considered these to be synonymous with Rydberg's Series Tuberosa.

Still other examples can be cited with respect to the serial classification of the South American species. The Series Andigena, Transaequatorialia and Vaviloviana were established and maintained by Bukasov (*cf.* Bukasov and Kameraz, 1959), but are treated as synonyms of the Series Tuberosa by Hawkes (1969, 1990) and Ochoa (1962).

Also, there exists much disagreement amongst taxonomists as to the serial placement of the Peruvian species. For example, according to Bukasov (1971), *S.*

cajamarquense belongs to the Series Minutifoliola; whereas, Ochoa (1982) and Hawkes (1990) consider this species to be a member of the Series Tuberosa. Similarly, Bukasov places *S. marinasense* within the Series Piurana, while Hawkes, who authored that series, has considered it instead as a member of the Series Tuberosa. Again, the species *S. huancabambense* is placed in the Series Piurana by Bukasov; whereas, Hawkes (1990) treats it as a member of the Series Yungasensa. However, Ochoa, who originally named *S. huancabambense*, places this species in the Series Tuberosa. Further realignments have been made by the author of this work, who regards Gorbatenko's (1989) recently described Series Chomatophila as being synonymous with the Series Conicibaccata, and his Series Pyriformia and Bukasoviana (including its six subseries) to be synonymous with the Series Tuberosa.

In the following section, an attempt is made to list all of the known serial names that have been published for the Section Petota since the time of Bitter, including those which fall within the category of a *nom. nud.* or a *grad. ambig.* The place of publication, type species and country of origin are given for each series. Only the serial names presented in bold face type are treated extensively in the present work.

Alticola Buk., Prob. Bot. 2:319, 1955, *nomen inval.* Type Species: *S. alticola* Bitt., Bolivia.

Acaulia Juz., Bull. Acad. Sci. USSR ser. Biol. 2:316, 1937, *nom. nud.* Buk. et Kameraz, Bases of Potato Breeding 21, 1959. Type Species: *S. acaule* Bitt, Bolivia.

Andigena Buk. ex Buk. & Kameraz, Bases of Potato Breeding 24, 1959. Type Species: *S. andigenum* Juz. et Buk., Peru.

Andreana Hawkes, Bull. Imp. Bur. Pl. Breed. & Genet., *nom. nud.* Cambridge 2:50, 1944. Type Species: *S. adreanum* Baker, Colombia.

Aracciana *Grad. ambig.* Buk., Prop Bot. 2:320, 1955, *nom. inval.* Type Species: *S. aracc-papa* Juz., Peru.

Borealia Corr., *The Potato and its Wild Relatives* 388, 1962. Type species not designated.

Berthaultiana (Buk.) *nom. nud.*, Bull. Appl. Bot. Genet. & Pl. Breed. 46(1):2426, 1971 (=Subseries Berthaultiana (Buk.) Gorbat., Bull. Appl. Bot. Genet. & Pl. Breed. 126:105, 1989). Type Species: *S. berthaultii* Hawkes, Bolivia.

Bulbocastana Rydb., Bull Torrey Bot. Club 51:146, 172, 1924. Type Species: *S. bulbocastanum* Dun., Mexico.

Bukasoviana Gorb., Bull. Appl. Bot. Genet. & Pl. Breed. 126:100, 1989. Type Species: *S. bukasovii* Juz., Peru.

Cardiophylla Buk., Bases of Potato Breeding 26, 1959, Type Species: *S. cardiophyllum*, Lindl., Mexico.

Circaeifolia Hawkes, Ann. and Mag. Nat. Hist., ser. 12, 7:702, 1954. Type Species: *S. circaeifolium* Bitt., Bolivia.

Clara Graham & Dionne. *In* Correll *The Potatoes and its Wild Relatives* 243, 1962. Type Species: *S. clarum* Corr., Guatemala.

Collina Buk. *nom. nud.*, Bull. Vavilov Inst. of Pl. Industry 105:9, 1980 (=Subseries Collina (Buk.) Gorbat. Bull. Appl. Bot. Genet. & Pl. Breed. 126:104, 1989). Type Species *S. chancayense* Ochoa, Peru.

Commersoniana Buk. ex Buk. & Kameraz, Bases of Potato Breeding 19, 1959. Type Species: *S. commersonii* Dun., Uruguay.

Conicibaccata Bitt., Repert. Spec. Nov. 11:381, 1912. Lectotype (designated by D'Arcy, 1972): *S. oxycarpum* Schiede, Mexico.

Cuneoalata Hawkes, Bull. Imp. Bur Pl. Breed. & Genet. Cambridge 118, 1944, Type Species: *S. infundibuliforme* Phil., Chile.

Chomatophila Gorbat., Bull. Appl. Bot. Genet. Pl. Breed. 126:95, 1989. Type Species: *S. chomatophillum* Bitt., Peru.

Demissa Buk. ex Buk. & Kameraz., Bases of Potato Breeding 27, 1959. Type Species: *S. demissum* Lindl., Mexico.

Etuberosa Juz., Buk & Kameraz, Bases of Potato Breeding 18, 1959. Type Species: *S. etuberosum* Lindl., Chile.

Glabrescentia Buk, Problemy Bot. 2, 318, 1955, *nom. inval.*, ex-Buk. & Kameraz, Bases of Potato Breeding 19, 1959. Type species not designated.

Ingaefolia Ochoa, *Los Solanum Tuberíferos Silvestres del Perú*, Lima, 68, 1962; ex Correll, *in* Texas Res. Found. Contrib. 4, 129, 1962. Type Species: *S. ingaefolium* Ochoa, Peru.

Juglandifolia Rydb., *Grad. ambig.*, Bull. Torrey Bot. Club 51:173, 1924, *nom. nud.* Juglandifolia (Rydb) D'Arcy, *in* Annals of the Missouri Bot. Garden p. 269, 1972. Type Species: *S. juglandifolium* Dun., Colombia.

Lignicaulia Buk. et Gorbat., Bull Appl. Bot. Genet. & Pl. Breed. 126:104, 1989. Type Species: *S. lignicaule* Vargas, Peru.

Longipedicellata Buk., ex Buk. & Kameraz, Bases of Potato Breeding 27, 1959. Type Species: *S. longipedicellatum* Bitt., Mexico.

Maglia Bitt., Fedde Repert. 11:360, 1912. Type Species: *S. maglia* Schlechtd., Chile.

Megistacroloba Card. et Hawkes, J. Linn Soc. Bot. 53:93, 1946, Type Species: *S. megistacrolobum* Bitt., Bolivia.

Minutifoliola Corr., *The Potatoes and its Wild Relatives* p. 216, 1962. Type Species: *S. minutifoliolum* Corr., Ecuador.

Morelliformia Hawkes, Scottish Plant Breed. Sta. Ann. Report., 54, 1956. Type Species: *S. morelliforme* Bitt. et Muench., Mexico.

Olmosiana Ochoa, Ann. Cient. Univ. Nac. Agraria, Lima 3(1):33, 1965. Type Species: *S. olmosense* Ochoa, Peru.

Oxycarpa Rydb., *Grad. ambig.*, Bull. Torrey Bot. Club 51:146, 172, 1924, *nom. nud.* Type Species: *S. oxycarpum* Schiede, Mexico.

Pinnatisecta Rydb., *Grad. ambig.*, Bull. Torrey Bot. Club. 51:146, 167, 1924, *nom. nud.* Type Species: *S. pinnatissectum* Dun., Mexico.

Piurana Hawkes, Ann. Mag. Nat. Hist. ser. 12, 7:693, 1954. Type Species: *S. piurae* Bitt., Peru.

Polyadenia Buk., ex Buk. & Kameraz, Bases of Potato Breeding p. 26, 1959. Type Species: *S. polyadenium* Greenm., Mexico.

Pyriformia Gorbat., Bull. Appl. Bot. Genet. & Pl. Breed. 126:100, 1989. Type Species: *S. taulisense* Ochoa, Peru.

Simpliciora Buk. et Gorbat., Bull. Bot. Genet. & Pl. Breed. 126:105-106, August 1989. Type Species: *S. simplicifolium* Bitt., Argentina.

Simplicissima Ochoa, Rev. Acad. Colom. Cien. 17(65):321, July 1989. Type Species: *S. simplicissimum* Ochoa, Peru.

Tarijensa Corr., *The Potato and its Wild Relatives* p. 233, 1962. Type Species: *S. tarijense* Hawkes, Bolivia.

Transaequatorialia Buk. in Buk. & Kameraz, Bases of Potato Breeding 21, 1959. Type species not designated.

Trifida Corr., Texas Res. Found. Contrib. 1:12, 1950. Type Species: *S. trifidum* Corr., Mexico.

Tuberosa Rydb., *Grad. ambig.*, Bull. Torrey Bot. Club 51:146, 147, 1924, *nom. nud.* ex Buk. & Kameraz, Bases of Potato Breeding 18, 1959. Type Species: *S. tuberosum* L.

Vaviloviana Buk. & Kameraz, Bases of Potato Breeding 18, 1959. Type Species: *S. vavilovii* Juz. et Buk., Peru.

Virgultora Buk. *nom. nud.*, Bull. Vavilov Inst. of Pl. Industry 105:9, 1980 (=Subseries Virgultoria Buk. et Gorbat., Bull. Appl. Bot. Genet. & Pl. Breed. 126:103, 1989). Type Species: *S. virgultorum* (Bitt.) Cárd. et Hawkes, Bolivia.

Yungasensa Corr., *The Potato and its Wild Relatives* 220, 1962. Type Species: *S. yungasense* Hawkes, Bolivia.

In the present taxonomic treatment of the Peruvian wild species of potato, the hierarchical arrangement of the higher groups is as follows: Genus *Solanum* L.; Subgenus Potatoe (G. Don) D'Arcy; Section Petota Dumortier and Subsection Potatoe G. Don. Subsection Potatoe is broken down into the following ten series: Acaulia Juzepczuk, Conicibaccata Bitter, Cuneolalata Hawkes, Ingaefolia Ochoa, Lignicaulia (Buk.) Gorbatenko, Megistacroloba Cárd. And Hawkes, Olmosiana Ochoa, Piurana Hawkes, Simplicissima Ochoa, Tuberosa (Rydb.) Hawkes and Yungasensa Hawkes.

Genetic Potential

Currently, there are about 225 species of tuber-bearing *Solanum* that are known to science. However, comparatively few of these species have been investigated with respect to their use in potato breeding programs or, for that matter, with respect to their interspecific crossability or phylogentic relationships (Bukasov, 1938; Thung, 1947; Howard and Swaminathan, 1952; Wangenheim, 1954; Hawkes, 1956b, 1958; Hougas and Peloquin, 1960; Matsubayashi, 1951a, 1982; Haneman and Peloquin, 1967, 1968; Brücher, 1968; Broksh, 1982; Budin, 1982; Kameraz *et al.*, 1982; Ochoa and Schmiediche, 1983; Douches and Quiroz, 1987; López and Hawkes, 1988; Camadro and Espinillo, 1990). With few exceptions, this situation is particularly critical with respect to the potential uses of the Peruvian wild species of potato (Hermsen and Ramana, 1969; Hogenborn, 1975; Schmiediche and Martin, 1983, 1986; Rabinowitz *et al.*, 1987, 1990; and Trognitz, 1993).

Although the diploid species are believed to be largely self-compatible (Pandey, 1960; Pushkarnath, 1952; and Trognitz, 1993), much more experimental work needs to be done. In actuality, little is known about the compatibility or incompatiblity of the great majority of the species. Similarly, it has not been definitively shown that the failure of plants to cross in this group is attributable in all cases to the lack of genetic compatiblity between the species, but rather to other problems of an inherent nature (*cf.* Ascher, 1966; and Cipar *et al.*, 1964 and 1964a).

Presented in the following work are the results of literally thousands of interspecific crosses involving Peruvian species, some of which, at least, were in the past little known genetically. Although in most cases the crosses were not taken past the F_1 generation, this level of crossing was nevertheless sufficient to permit certain inferences to be made with regard to the crossability of species showing little morphological relationship, or ones in which either the numerical endosperm balance or the chromosome numbers differed in value. Thus, in cases where our artificial crosses resulted in the production of highly fertile hybrids, this was taken as confirmation that the species involved were indeed very closely related to one another. On the other hand, no attempt was made here to try and single out the many causes of incompatibility that are known to work between the various tuber-bearing species of *Solanum* in nature, as this was not the original intent of this study. However, for additional information on the subject, including the action of stylar hormones on the growth of the pollen tube, the reader is referred to papers by Grun (1961), Grun and Radlow (1961), Grun and Aubertin (1966), Hermsen (1979), Trognitz and Schmiediche (1993) and Bamberg (1995).

Yet another problem that had to be addressed in the course of the current study concerns the importance of the numerical endosperm balance as a taxonomic character and evolutionary marker in *Solanum*, Section Petota, a subject that has been explored at various times in the past by Johnston and Hanneman (1978, 1980, 1981, 1982), Ehlenfeldt and Hanneman (1984, 1988), Hanneman (1983, 1981) and Hawkes and Jackson (1992). Normally, the development of viable seed in the diploid species of *Solanum* is dependent upon the development of triploid endosperm, which in the course of its formation receives two sets of chromosomes contributed by the maternal parent and one set by the paternal parent, or, in other words, a ratio of maternal to paternal genes of 2:1. This same ratio must be maintained in the endosperm of interspecific crosses in order for their seeds to be successfully formed. In determining the numerical value of the endosperm balance, the species in question is first crossed with *S. commersonii*, a wild species from the Cuenca del Plata of Uruguay and Argentina. This particular diploid species, which has been selected for use as a standard in such experiments, is used always as the pistillate parent in such crosses. It's predetermined numerical endosperm balance has been assigned the value of 1. In many cases, a second cross to corroborate the findings of the first is performed using the very floriferous and extra long-flowering Peruvian diploid *S. mochiquense*, a species which has also been assigned a numerical endosperm value of 1.

Finally, in order to better interpret the charts of crossability that are presented in the current work, it was decided to include the following data sets in each: Staminate, or Pistillate Parent in the case of reciprocal crosses; Number of Flowers Pollinated (FL); Total Number of Berries Obtained (TB); and, Average Number of Seed Obtained (SB). The results of reciprocal crosses have been expressed in the form of a numerical fraction, with the numerator representing the total number of seeds obtained in crosses where the primary species is used as the pistillate parent, while the denominator represents the results of the reciprocal combination. Unilateral crosses are represented by single entries.

As an example of how to interpret the charts on crossability that are included in the present work, we can run through some of the data given for the first species, *S. acaule* (see Table 1). Thus, in reciprocal crosses of *S. acaule* with *S. chomatophilum*, the results indicate that 60 pollinations (FL) were required to produce 47 fruits (TB) that averaged 13 seeds per berry (SB) when *S. acaule* was used as the pistillate parent; whereas, 19 pollinations were required to produce 13 berries that yielded an average of 16 seeds per berry when *S. acaule* was used as the staminate parent. On the other hand, when *S. acaule* was used as a pistillate parent in a unilateral cross with *S. coelestispetalum*, 4 pollinations were required to obtain 4 fruits that yielded an average of 13 seeds per berry.

KEY TO SERIES

- 1. Plants rosette-forming or without a well developed stem.
  - 2. Terminal leaflet equal or slightly larger than the laterals.
    - 3. Corolla rotate, small, 2.0-2.5 cm in dia. ....Series Acaulia
    - 3. Corolla rotate to rotate-pentagonal, much larger, 3.0 cm or more in dia. ....Series Conicibaccata
  - 2. Terminal leaflet much larger than the laterals.......Series Megistacroloba
- 1. Plants not rosette-forming, with well developed stems.
  - 4. Fruit long-conical ....Series Conicibaccata
  - 4. Fruit globose to ovoid.
    - 5. Leaves simple or imparipinnate with the terminal leaflet much larger than the laterals.
      - 6. Corolla purple or violet........................... Series Megistacroloba
      - 6. Corolla white... Series Simplicissima
    - 5. Leaves always imparipinnate with the terminal leaflet equal or slightly larger than the laterals.
      - 7. Lateral leaflets broadly decurrent about the rachis, forming a wedge along the length of each pair..................... Series Cuneoalata
      - 7. Lateral leaflets without decurrency or narrowly decurrent only along the first upper pair.
        - 8. Leaves with narrowly decurrent rachis.
          - 9. Corolla rotate .... Series Ingaefolia
          - 9. Corolla stellate.............................. Series Olmosiana
        - 8. Leaves without decurrency.
          - 10. Corolla stellate .... Series Yungasena
          - 10. Corolla rotate or pentagonal.
            - 11. Leaves coriaceous, fruit subellipsoid to ovoid, very rarely long-conical .... Series Piurana
            - 11. Leaves not coriaceous, fruit globose, pyriform to occasionally ellipsoid ....Series Tuberosa

SERIES ACAULIA

ACAULIA Juz., Bull. Acad. Sci. U.S.S.R., ser. Biol. 2:316, 1937, *nom. nud.*; ex Bukasov & Kameraz, *Bases of Potato Breeding*, p. 21, 1959.

Plants herbaceous, small, rosette-forming, stemless or with an extremely abbreviated stem, or occasionally with elongated internodes. Plants stoloniferous and tuber-bearing. Tubers small. Leaves imparipinnate with obtuse leaflets or acroscopically auriculate at base. Peduncle lacking or very short and few-flowered, the geotrophically-orientated pedicels normally marked below the calyx with a narrow ring of pigment, or rarely articulate. Corolla rotate, small, violet, blue-violet, white or whitish, with very short lobes and acumens. Chromosome numbers: 2n=48 or 2n=72. EBN=2 or 4.

Distribution

The members of this series extend from the Province of Chimborazo in northcentral Ecuador through the high mountain districts of Peru and Bolivia to the mountains of northwestern Argentina, at elevations ranging from 2600 to 4700 m.

Although this series was recognized by Hawkes (1956) and Brücher (1959a) on the basis of an informal proposal by Juzepczuk in1937, it was not until 1959 that the group was described and validated according to international rules.

Bukasov and Kameraz (1959) and Lechnovitch (1971) included *Solanum* × *juzepczukii* and *S.* × *curtilobum* in the series Acaulia. However, as both cultivated species are natural hybrids of *S. acaule* with cultivated species of the series Tuberosa, it would appear more convenient and logical to treat these with the cultivated species rather than under the present series.

The series Acaulia is comprised of the following two species: *S. acaule* Bitter (1912), a tetraploid (4x) which is widely distributed from the Andes of central Peru to the high mountains of northwestern Argentina, where occurs its only known variety, *S. acaule* var. *aemulans* Correll (1961; *cf.* Ochoa, 1990); and, *S. albicans* Ochoa (1983a), a hexaploid (6x) that is widely distributed from northern Peru to the Andes of north-central Ecuador.

Both species represent potentially valuable sources of potato germplasm. Of all the wild species so far tested, *S. acaule* and *S. albicans* are the ones that are most resistant to early frost and rapidly changing temperatures (Estrada, 1968, 1980, 1984; Calúa and Landeo, 1987; Camadro and Espinillo, 1990; Ross and Rowe, 1965, 1969; Palta and Li, 1979); Centro Internacional de la Papa, Inf. Anual 1973, p. 45; 1976, p. 59-60; 1977, p. 19, 94-95; 1978, p. 8, 51-52; 1979, p. XIII, 58; 1985, p. 101; Bamberg, 1994).

These two species are also known to incorporate some resistance to the cyst nematodes *Globodera rostochiensis* and *G. pallida* (Stone, 1972; Evans *et al.*, 1975; Hoopes, 1975; Centro Internacional de la Papa, Inf. Anual 1973, p. 42; 1977, p. 69; Bamberg, 1994) and the root node nematode, *Meloidogyne* sp. (Brodie and Plaisted, 1977; Jatala, 1977; Hooker, 1981; Bamberg, 1994). Both are also reported to be resistant to wilts of the genus *Verticillium* and *Fusarium* (Centro Internacional de la Papa, Inf. Anual 1992, p. 30-32), and both have been reported to stand up against the wart-causing organism *Synchytrium endobioticum* and the ring decay species *Corynebacterium sepedonicum* (Bamberg, 1994). Moreover, *S. acaule* has been found to be resistant to the bacterial wilt species *Pseudomonas solanacearum* (Centro Internacional de la Papa, Inf. Anual 1986-87, p. 77, 78; 1989, p. 4, 41, 46; Bamberg 1994), to the black leg disease organism *Erwinia carotovora* and to the early blight causing organism *Alternaria solani* (Centro Internacional de la Papa, Inf. Anual 1985, p. 20, 34; Bamberg, 1994).

Among the insects that *S. acaule* appears to be resistant to are the Andean weevil, *Premnotrypes suturicales* (Centro Internacional de la Papa, Inf. Annual 1979, p. 47; 1980, p. 49-50), and the potato leaf hopper, *Empoasca fabae* (Centro Internacional de la Papa, Inf. Annual 1977, p. 76).

Solutions to the problems of the viral and viroidal diseases of potatoes are being uncovered at CIP (*cf.* Hinostroza de Lekeu, 1979; Salazar, 1982; Lizárraga and Fernández-Northcote, 1989; Querci *et al.*, 1993a, 1993b). A high level of resistance to PSTVd, for example, was discovered in one germplasm sample of *S. acaule* (OCH-11603), which chromosomally appears to have incorporated the appropriate genes for immunity. Extreme resistance to PVX-c has also been found in various Peruvian and Bolivian collections of *S. acaule* (OCH 11818, 11823, 11825, 11889, 11890, 11912, 11983 and 11984).

According to Arbizu *et al.* (1991), *S. acaule* is strongly resistant to the viroid PSTVd, an organism that causes the formation of fusiform tubers in the potato (Centro Internacional de la Papa, Inf. Anual 1980, p. 31; 1982, p. 29, 52-53; 1983, p. 59, 62-63; 1988, p. 14, 34-36; 1989, p. 2, 15, 17, 58; 1990, p. 29, 48; 1991, p. 3, 8; Bamberg, 1994). Moreover, the writer has also observed that some clones of *S. acaule* when grown in the experimental fields of La Molina show appreciable resistance to PLRV. Many clones show a certain amount of tolerance to the late blight fungus, *Phytophthora infestans*, as well.

KEY TO SERIES ACAULIA

1. Leaves with (4-) 5-6 (-7) pairs of leaflets and (0-) 1-2 (-3) pairs of interjected leaflets; peduncle unbranched; articulation of the pedicel obsolete or inconspicuous; style short, usually inserted.......... 1. *S. acaule.*

1. Leaves with 1-3 (-4) pairs of leaflets and 0-1 (-2) pairs of interjected leaflets.
    2. Peduncle bifurcate; articulation of the pedicel evident or conspicuous; style elongate, exserted .... 2. *S. albicans.*
    2. Peduncle unbranched; articulation inconspicuous; style short, usually inserted .... 1a. *S. acaule* f. *incuyo.*

1. *Solanum acaule* Bitter, Repert. Sp. Nov. 11:391-393, 1912; 12:453, 1913. Figs. 1-8; Map 4

S. acaule var. *subexinterruptum* Bitt., Repert. Sp. Nov. 11:393-394, 1912. Type: *Buchtien 5858*, Bolivia, altiplano, 4100 m alt., March 1910 (US).

S. acaule var. *caulescens* Bitt., Repert. Sp. Nov. 12:453-454, 1913. Type: *Verne s.n.*, Bolivia.Viacha [3840 m alt.], near La Paz, plant grown at Grenoble, France, from tubers collected originally by Claude Verne (GOET).

S. punae Juz., Bull. Acad. Sci. U.S.S R., ser. Biol. 2:316, 1937. Type: *Juzepczuk 10414*, Peru. [Dept. of Cerro de Pasco, Prov. Daniel Carrion], Cerro de Pasco, in a formation called *puna*, among rocks and grasses near lake [ca. 4350 m alt.], February 2, 1927. Note: the same locality is given for No. *10435*, February 4, 1927 (LE, OCH, WIR).

S. depexum Juz., Bull. Acad. Sci. U.S.S.R., ser. Biol. 2:317, 1937. Type: *Rosenstiel s.n.*, Argentina. La Peña, between Jujuy and Salta, plants grown in Leningrad, 1935, from tubers originally collected by K. von Rosenstiel and shipped to Leningrad via R. Schick (LE).

S. schreiteri Buk., Sov. P1. Ind. Rec. 4:13, 1940, *nomen nudum* based on S*chick s.n.*, Argentina, San Jose, between Jujuy and Salta, plants grown near Leningrad, from tubers collected originally in 1932 by R. Schick (K-3 WIR).

S. acaule var. *checcae* Hawkes, Bull. Imp. Bur. P1. Breed. & Genet., Cambridge 2:22, 115, Fig. 5, 1944. Type: *Vargas 2005*, Peru, Dept. Cusco, Prov. Canas, Checca [3800 m alt.], February 26, 1939 (K, grown at Cambridge from seeds originally collected by Vargas).

S. depexum var. *chorruense* Hawkes, Bull. Imp. Bur. Pl. Breed. & Genet., Cambridge 2:23, 115, 1944. Type: *Balls 6026*, Argentina, Prov. Tilcara, near the summit of Chorru Valley, 4300 m alt., February 13, 1939 (CPC, not seen).

S. acaule var. *punae* (Juz.) Hawkes, Bull. Imp. Burl P1. Breed. & Genet., Cambridge 2:23, 1944. Type: Same as S. *punae* Juz.

S. uyunense Card., Bol. Soc. Peruana Bot. 5:33-35, Pl. III. C., Figs. 1-3, Pl. V.A, 1956. Type: *Cardenas 5474*, Bolivia, Dept. Potosi, Prov. Quijarro, between Uyunito and Chocaya, 3800 m alt., March 1952 (CA, LL).

S. acaule subsp. *aemulans* (Bitt. et Wittm.) Hawkes & Hjerting, *in* Hawkes, Scott. Pl. Breed. Stn. Rec. 116, 1963. Type: *Hieronymus and Niederlein 474* (fragment and Photo, GH).

S. acaule subsp. *punae* (Juz.) Hawkes & Hjerting, *in* Hawkes, Scott. Pl. Breed. Stn. Rec. 117, 1963. Type: Same as S. *punae* Juz.

S. acaule subsp. *acaule* (Bitt.) Hawkes & Hjerting, *The Potato*, 184, 1990.

Plants small, prostrate or semi-prostrate, rhizomatous, normally stemless, forming rosettes (5-)15-20(-40) cm in diameter (Figs. 1 and 2) or occasionally caulescent under certain conditions of growth, sparsely pilose with fine, white, unequally-sized hairs 2-4 mm long and shortly-tetralobular glandular hairs. Stolons long and thick, white or milky-white, 50-70 cm or more in length and 0.2-0.4 cm in diameter, producing at occasional intervals rosette-like plantlets. Tubers small, (1.0-)1.5-2.0(-4.0) cm in diameter, white, round, ovoid or flattened. Leaves imparipinnate, long and narrow, (2.2)6.0-15(-20) cm in length and (0.6-)4.0-7.0(-9.0) cm broad, with (2-)3-5(-6) pairs of lateral leaflets and 0-2(-3) pairs of very small, sessile interjected leaflets, sparsely pubescent with short, subadpressed hairs; petiole (0.2-)1.0-3.0 in length, enlarged at base; rachis subcylindric and covered with long, sparsely distributed multicellular hairs. Leaflets somewhat rugose, enlarging gradually in size from the base to the apex, sessile; terminal leaflet from slightly larger to much larger in size than the laterals, (1.0-)3.5-4.5(-7.5) cm long by (0.5-)2.5-3.5(-5.5) cm wide, broadly ovate-rhoboid to ovate-elliptic or oblong to almost orbicular; apex obtuse or rounded; base abruptly cuneate. Lateral leaflets ovate-elliptic or broadly ovate-elliptic to

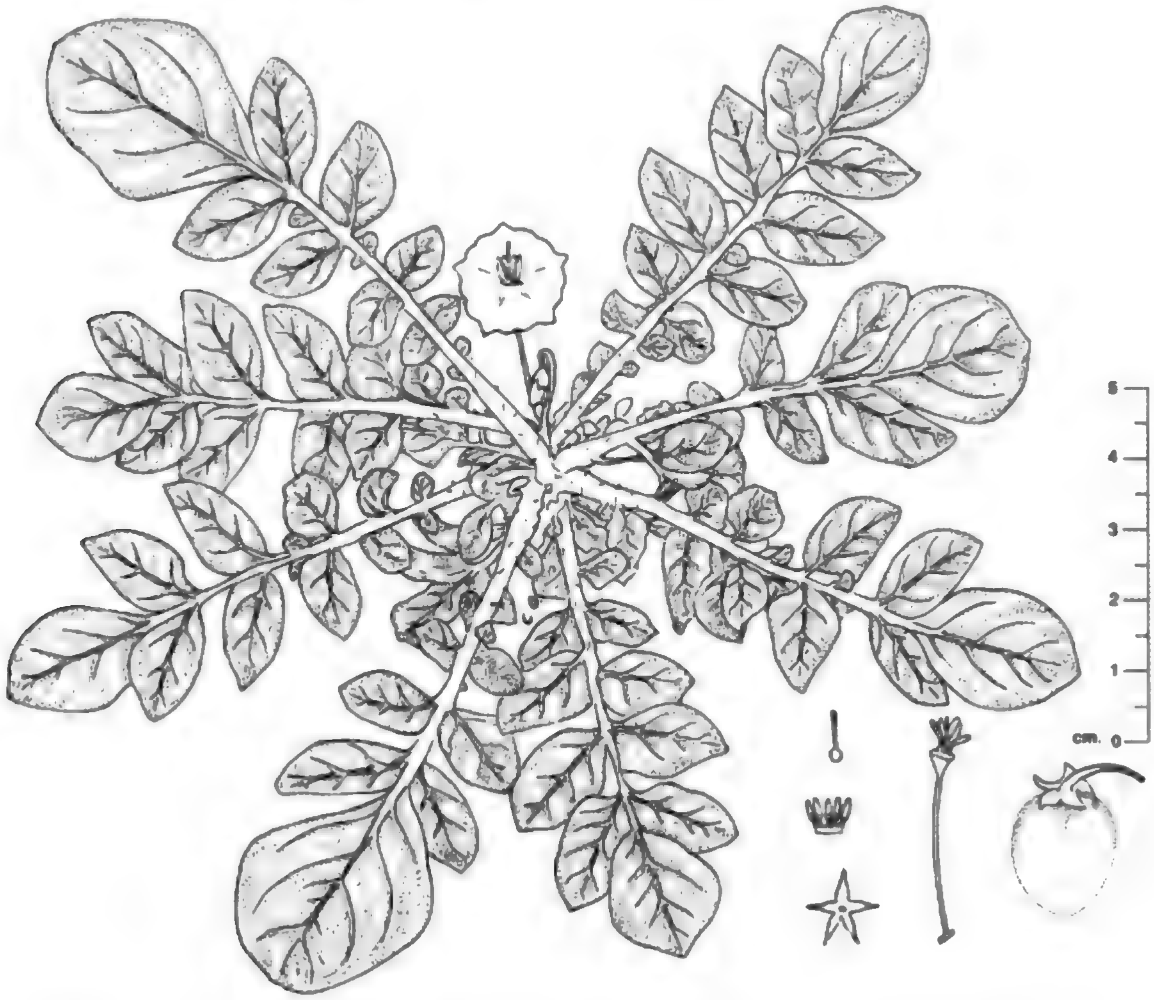


Figure. 1 Drawing of *Solanum acaule* Bitt. (*Ochoa 8612*). Specimen from Espinar, Cusco, near the type locality of S. *acaule* var. *checcae* Hawkes.

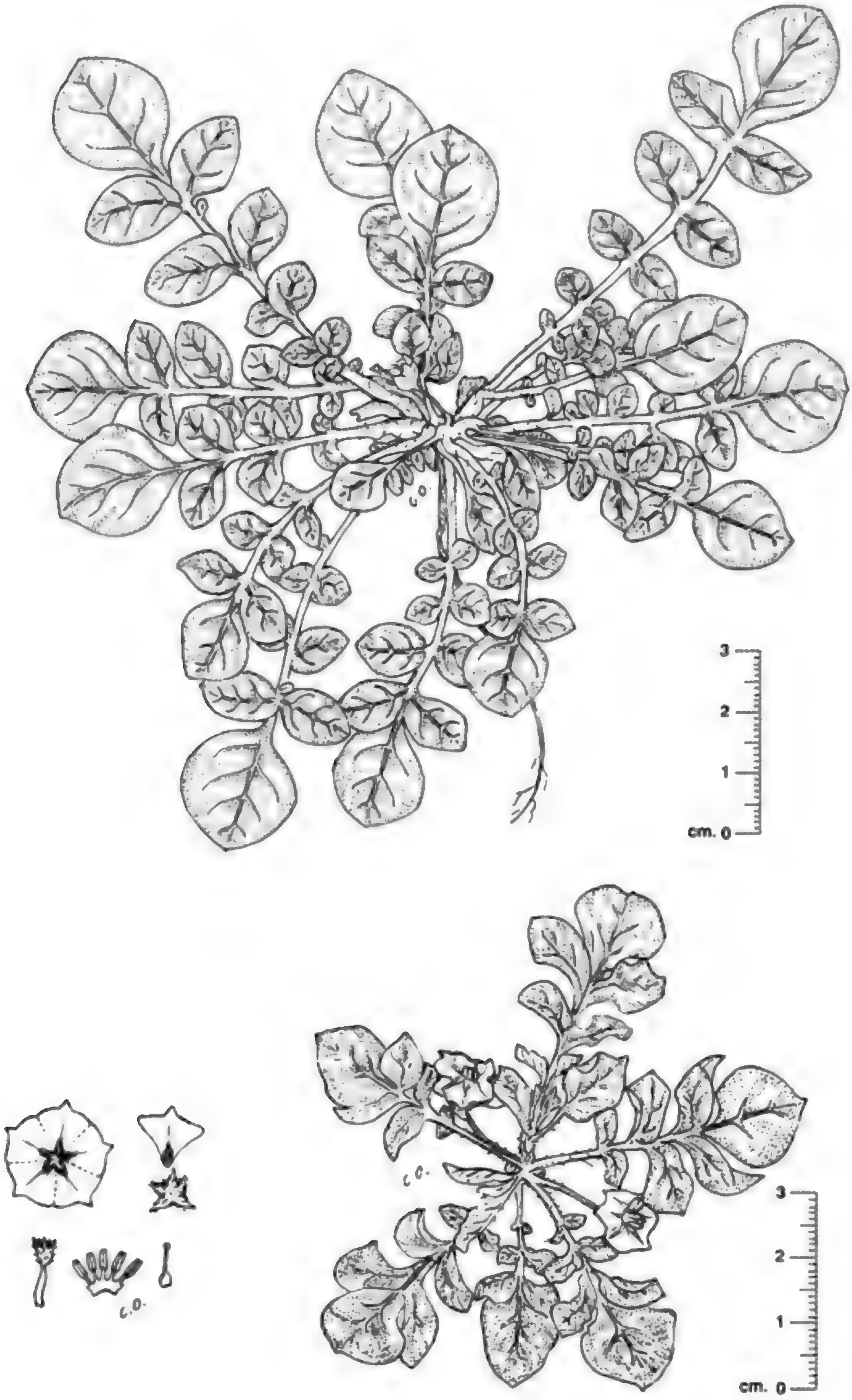


Figure 2. *Solanum acaule* Bitt. Top: Drawing of a specimen taken from the vicinity of Lake Junin, near the type locality of S. *punae* Juz. (*Ochoa 13865*). Bottom: Drawing of a specimen collected from the immediate type locality of *S. punae* Juz. (*Ochoa 13871*).

oblong; (1.0-)3.0-3.5(-4.0) cm long by (0.6-)1.5-2.5(-3.0) broad, apex rounded to obtuse; base auricular on the acroscopic side and variously earred to decurrent basiscopically. Pseudostipular leaves inconspicuous, very small or absent. Inflorescence with 1-4(-7) flowers. Peduncle lacking or extremely short, no more than 3-7 mm in length, originating usually in the crown of the plant near the center of the rosette or, in the case of plants that bear stems that are slightly elongated, in the axils of leaves. Pedicels 5-25(-40) mm long, generally pigmented violet, glabrous or sparsely covered with long hairs; articulation absent or inconspicuous, apparent only by a slight change in the thickness of the pedicel or by the presence of a narrow band of pigment situated 2-3 mm below the base of the calyx. Calyx symmetrical or asymmetrical, campanulate, sparsely pilose, 3-4 mm long; lobes broadly ovate-triangular to lanceolate-subobtuse, shortly acuminate or subacuminate; acumens 0.5-1.5 mm long. Corolla rotate, small, (1.0-)1.5-2.0 (-2.5) cm in diameter, generally blue-violet or violet with white acumens, rarely whitish; lobules extremely short, 1.4-2.2 mm in length; acumens broadly triangular, short, 1.5-2.0 mm long, puberulent along the margins of the apices. Anthers short, 2.5-3.0(-4.0) mm long, ellipsoid to oblong in dorsal view; filaments 1.5-2.5(-3.0) mm long, slender and glabrous. Style short, 4.5-5.5 mm long, thick, inserted or very scarcely exserted (0.5 mm), papillose on lower half; stigma large, about 1 mm long, capitate. Fruit 15-20 mm in diameter, round to ovoid subcompressed (Fig. 3), occasionally long-conical, the apex pointed (Fig. 4), green to dark green, often tinged with violet at base. Fruits and pedicels with geotrophic tendencies, this especially evident in biotypes that grow in open fields at high elevations. Chromosome Number: 2n=4x=48. EBN=2.

Local Names: *Apharu* (=Wild) or *Apharuma Chokke* (=Wild Potato), used throughout the altiplano region of Peru and Bolivia; and, *Jupaypa Papan* (=Devil Potato) in Pasco and Junín.

Type: BOLIVIA. Department Tarija, Province Aviles, Puna Patanca, 3700 m alt., January 8, 1904; *K. Friebrig 3429* (lectotype of *S. acaule* subsp. *acaule* designated by Hawkes and Hjerting, S; isotypes F, G, HBG, M, NY, O, SI, W).

This species is strongly subject to environmental modifications. In the open fields of the high *puna* regions of the Andes plants of *S. acaule* assume a small, rosette-like habit without central stem and bear fruits near or slightly below the level of the soil. Frequently, the downward-growing pedicels of this species are responsible for the imbedding of the immature fruits in the soil, thus ensuring their maturation and seed production, this apparently an adaptation for survival in high altitude areas that are subject to early frost. At lower elevation regions of the Andes or in the interandean valleys, the plants of this species develop a longer

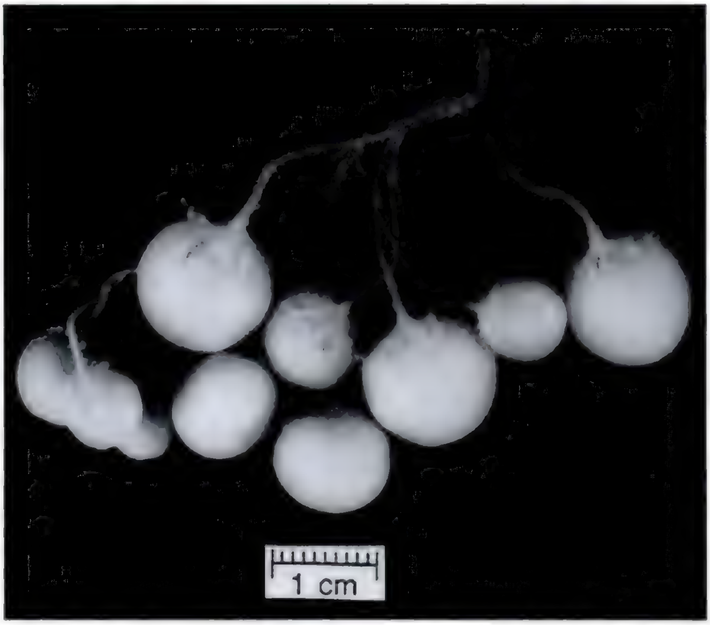


Figure 3. Rounded berries of *Solanum acaule* Bitt. (*Ochoa 11604*).

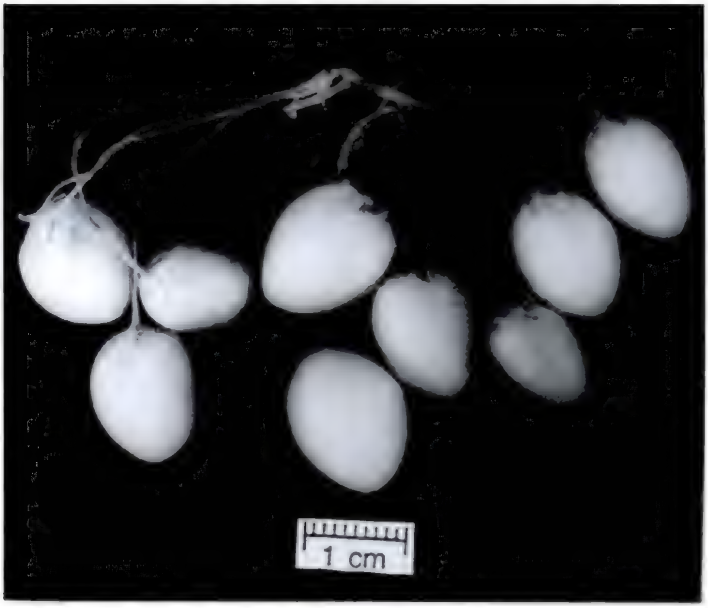


Figure 4. Ovoid to long-conical berries of *Solanum acaule* Bitt. (*Ochoa 11304*).

stem and the leaves and leaflets are of different shape or dissection. A classic example of the extreme environmental plasticity of *S. acaule* is demonstrated in a collection of this species that was obtained by Claude Verne near Viacha, Bolivia (3900 m alt.), the original tubers of which were sown in an experimental field near Grenoble, France. In this case, the plants that developed in the experimental field were of strikingly different appearance from the specimens that were originally pressed in Bolivia. Bitter (1913), who was unaware of the original source of these field-grown collections, believed they represented a new variety of *S. acaule* and because these plants were prominently stemmed, he referred to them as *S. acaule* var. *caulescens* Bitter. The type of the latter (reduced to synonomy in the present treatment) is presently housed in the Göttingen Herbarium (GOET).

Although the color of the flower in *S. acaule* appears predominantly blue or violet, this character is rather variable, as is the case with anthocyanin pigments, plant pubescence and the dissection of the leaves. Also, the color of the entire plant, while green, can vary from light green to very dark green. The author's observations on populations of living plants obtained from many different areas of Peru and grown under uniform field conditions at the CIP experimental station (3250 m alt.) in the Mantaro Valley near Huancayo, confirm the extreme environmental plasticity of this species. In collections of *S. acaule* that were grown at this experimental station but originally obtained at Checca (and other localities in the high provinces of Cusco in the southern part of Peru) were seen variants with white, lilac or dark purple flowers, these very similar to the types that occur in the Department of Ancash, which is located about a thousand kilometers north of the first mentioned locality. Also, forms with leaves very similar in appearance and dissection to certain Cerro de Pasco plants that were originally described as *S. punae* Juz. (see above synonymy) appeared among the various collections from distant localities. Another example of this is shown in Figs. 1 and 2, which illustrate topotypes of *S. acaule* var. *checcae* Hawkes (*OCH 8612*) and *S. punae* Juz. (*OCH 13865* and *13871*). Essentially, the plants from the two localities are basically alike, exhibiting few (if any) important differences. In summary, if one compares the synonymy given here with that presented by Correll (1962), Hawkes and Hjerting (1989) and Ochoa (1990), the only logical conclusion that can bedrawn is that these plants represent merely different genotypes of the same species. To date, the only variant that appears to have been legitimately described is *S. acaule* var. *aemulans* (Bitt. et Wittm.) Corr., from northwestern Argentina.

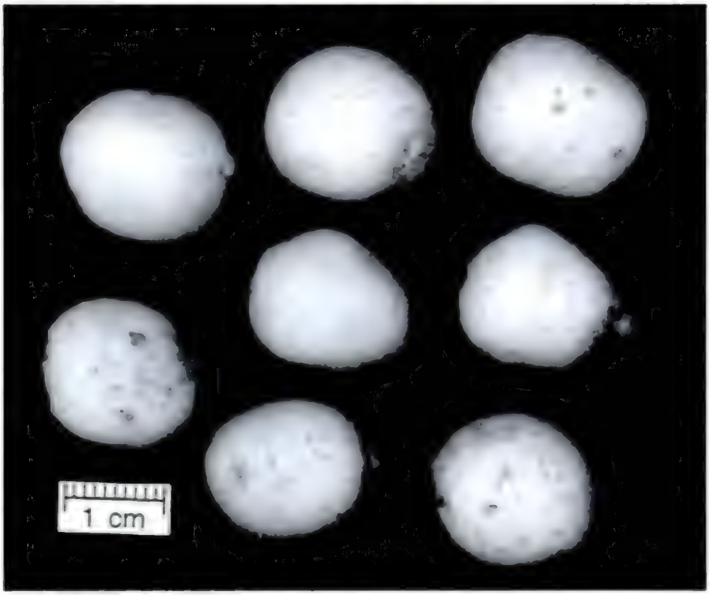


Figure 5. Tubers of *Solanum acaule* Bitt. (*Ochoa 13872*).

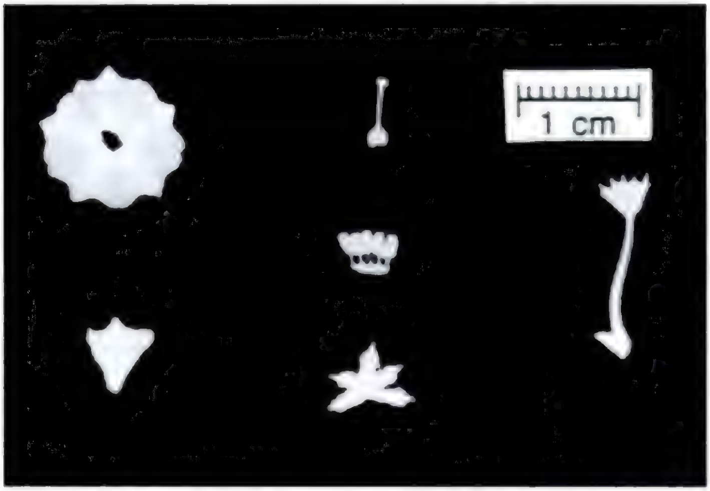


Figure 6. Floral dissection of *Solanum acaule* Bitt. (*Ochoa 13872*).

Affinities

Solanum acaule, while probably more closely related to *S. albicans* than to any other species, shows some affinity to plants of the series Megistacroloba (*cf.* Hawkes and Hjerting, 1989). Especially evident in this regard are the many features shared by *S. acaule* and *S. megistacrolobum* and *S.* × *brucheri* (Ochoa, 1990).

Another point of interest here is that colonies of wild potato plants in the high puna grasslands of central Peru often contain immature individuals of *S. bukasovii* that are completely similar to *S. acaule* in habit and leaf dissection. These small, rosette-like plants which flower and fruit later than is normally the case for *S. acaule*, are so similar in appearance to *S. acaule* that they could possibly be taken for a diploid ancestor of this species.

Additional notes on the evolutionary relationships of this plant may be found in Hawkes and Hjerting (1989), and Ochoa (1990).

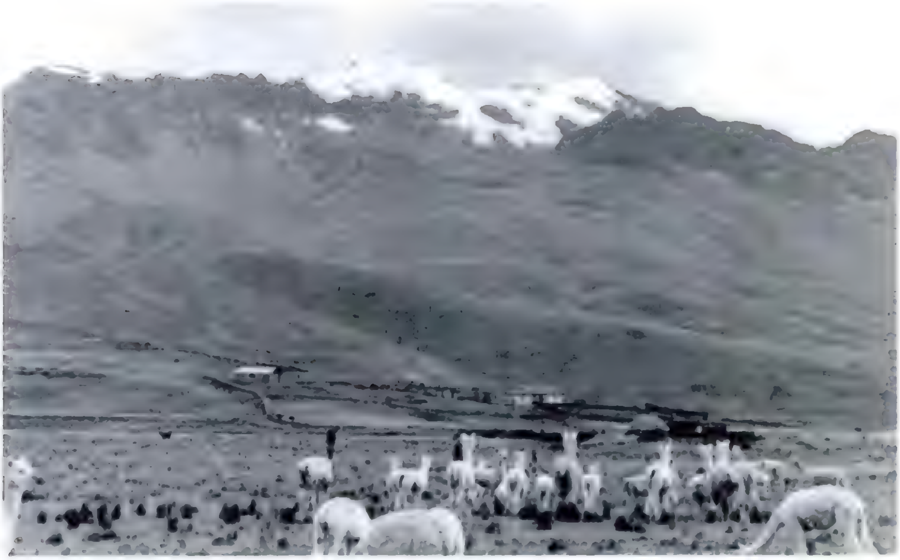


Figure 7. Habitat of *Solanum acaule* Bitt. Kunurana (5000 m alt.), near Santa Rosa, Puno, southern Peru. In the foreground, a typically flat landscape of *puna* grassland with a herd of alpacas grazing on plants of the genus *Stipa, Poa, Muhlenbergia* and S. *acaule.*

Habitat and Distribution

The natural habitat of *S. acaule* lies in the *puna*, a high, cold grassland where the temperature usually averages less than 7° C annually. In this region it is generally closely associated with *Stipa ichu* and other *puna* grasses (Fig. 8). It also grows near low colonies of *Astragalus* and *Lepidophyllum*, or between individual plants of *Lupinus microphyllum*, *Gentiana*, *Distichia*, *Ranunculus*, *Galitriche*, *Limosella* and *Lilaea*.

In some areas of the Peruvian high Andes, *Solanum acaule* grows in close association with *S. bukasovii*. The two species occur together in *puna* formations near the towns of Huancayo, Concepción and Jauja in the Department of Junín. They are also found together in the *puna* grasslands of the Provinces of Canchis, Quispicanchis and Canas in the Department of Cusco.

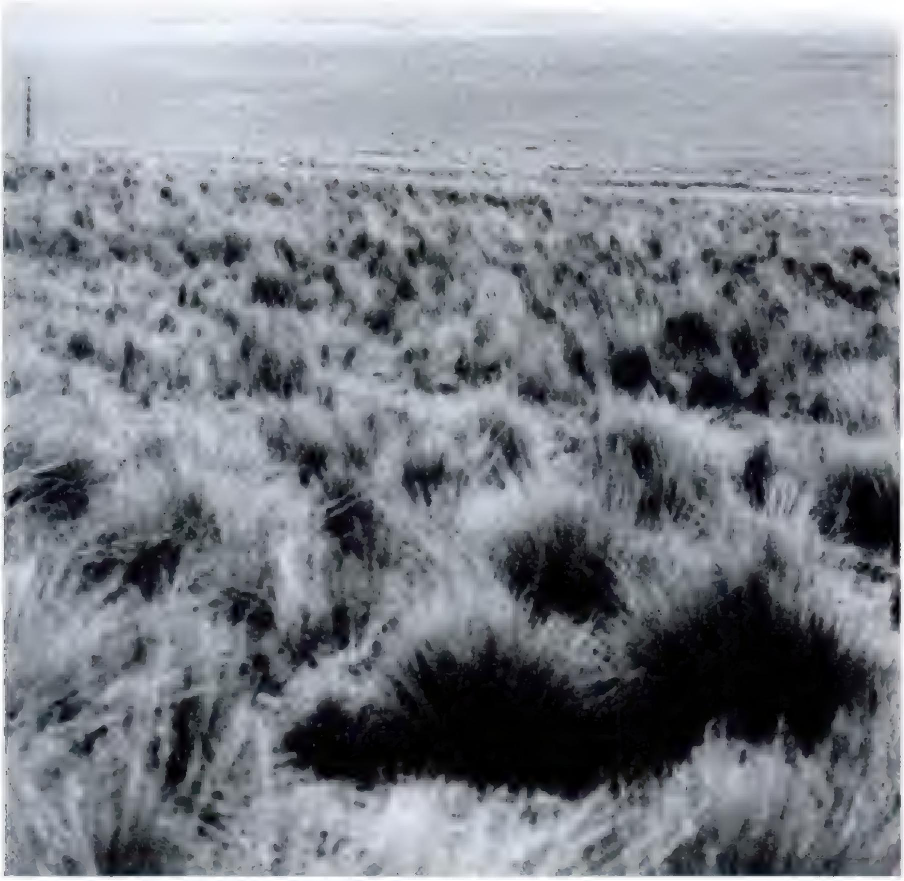


Figure 8. Habitat of *Solanum acaule* Bitt. Grasslands located near Lake Junin and Cerro de Pasco in central Peru (4200-4400 m alt.).

Solanum acaule generally forms carpet-like mats at altitudes between 3500 and 4500 m. Its altitudinal range in Peru, however, varies between 2600 and 4570 m. No other wild tuber-bearing species of *Solanum* are known to grow at elevations higher than that known for *S. acaule*, and no others are known to be as widely distributed in nature.

As pointed out by Ugent (1981), the seeds of *S. acaule* are often disseminated in nature by llamas and alpacas, or occasionally by other grazing animals and birds (Fig. 7).

The distribution of *S. acaule* extends some 2500 km along the length of the Andes, from Puca Chaca in northern Peru (Prov. Sihuas, Dept. Ancash; 8°3' S, 77°38' W) to Chilecito in the sierras of *Famatina* in northwestern Argentina (Prov. La Rioja; 29°10' S, 67°30 W). In Peru, the southern-most locality of this species is located near the border of Bolivia at Ckenamari (Prov. Azangaro, Dept. Puno; 17°28' S, 69°22' W). Along the eastern side of its range, the north-south range of the species extends from Shincos (Prov. Bolgnesi, Dept. Ancash; 10°09' S, 77°09' W) to Cojata (Prov. Huancané, Dept. Puno; 15°01' S, 69°22'W).

Specimens Examined

Department Ancash

Province Bolognesi: Border of the water reservoir at Huancar, 3880 m alt., 26 April 1949, *E. Cerrate 344* (OCH, USM). Near Llipa Mine, 3900 m alt., 20-22 March 1978, *C. Ochoa and Salas 12059*, 2n=48 (CIP, OCH). Shincos, 3900 m alt., near km 13 on the Chiquián-Conococha road, 2 May 1984, *C. Ochoa and A. Salas 15725, 15726* (OCH), *15727* (CIP, OCH, from plants grown at CIP-Huancayo, all with 2n=48), and *15728* (OCH). Mojo, 4050 m alt., some 20 km from Chiquián along the route to Conococha, associated with *Stipa ichu*, 2 May 1984, *C. Ochoa and A. Salas 15729*, 2n=48 (CIP, OCH), *15730*, 2n=48 (OCH). Pishgosh, 3900 m alt., about 28 km from Chiquián on the road to Conococha, among rocks, associated with *Stipa* sp., 2 May 1984, *C. Ochoa and A. Salas 15731*, 2n=48 (OCH) and (CIP, from plants grown in the greenhouse at CIP-Huancayo).

Province Huari: Tambillo, 3900 m alt., slopes below the Cawish tunnel and towards the bridge over the Cawish River, 13 April 1978, *C. Ochoa 12073*, 2n=48 (CIP, F, NY, US, from plants grown at CIP-Huancayo).

Province Recuay: About rock walls on mountain slope, 3750 m alt., 30 March 1960, *D.S. Correll and E.E. Smith P966 p.p.*, plant-2 (LL). Between Ticapampa and Cawish Pass, 4400 m alt., just before the Cawish tunnel on the Ticapampa-Chavín road, 13 March 1978, *C. Ochoa 12069 p.p.* (OCH), plants *12069-1* and *12069-2* with 2n=48 (CIP, OCH, US, from plants grown in the

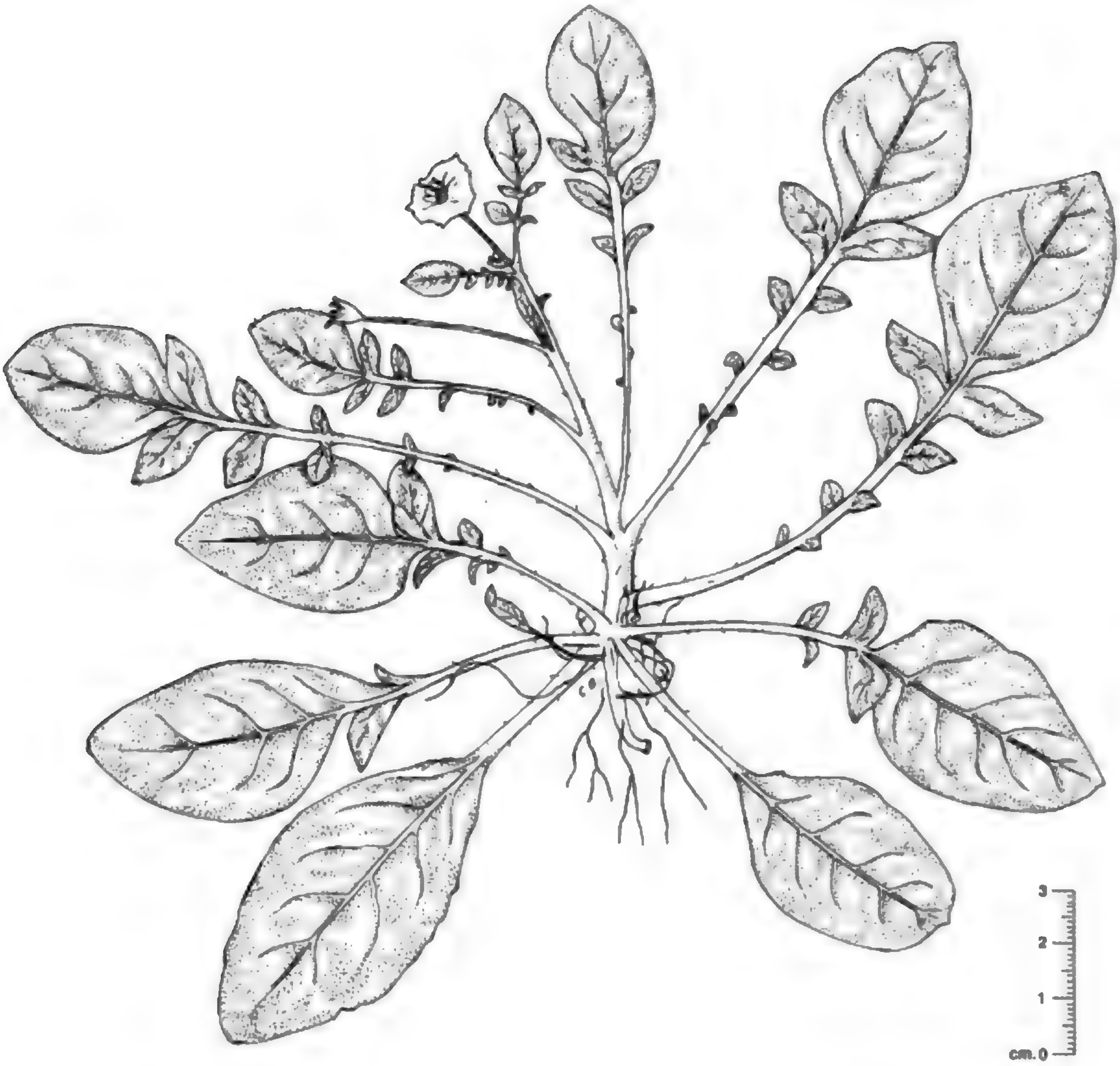


Figure 9. Drawing of *Solanum acaule* f. *incuyo* Ochoa (*Ochoa 9834*, holotype).

greenhouse at Huancayo). Carpa, 3950 m alt., beneath plants of *Puya raimondi*, berries round to ovoid, 18 April 1978, *C. Ochoa 12092*, 2n=48 (CIP, F, NY, US). Ayamachay, 4000 m alt., between Catac and Chavín, before the entrance of the Cawish tunnel, abundant, growing ne ar *S. dolichocremastrum* in an open grassy field, flowers very dark purple with very conspicuous pedicel articulation, 7 April 1995, *C. Ochoa and A. Salas 16219* (CIP, OCH).

Province Sihuas: Puca Chaca, 4100 m alt., between Tarica and Sihuas, 3-6 May 1978, *C. Ochoa 13005*, 2n=48 (CIP, NY, OCH, US), and *13005A* (OCH).

Department Apurímac

Province Abancay: Parguania, on road from Coinora to Huanipaca, 21 February 1960, *C. Ochoa S-17* (*=PI-365305*, from living plants grown at Sturgeon Bay, Wis., USA, summer 1987) and (US).

Province Andahuaylas: Pisaccalla, 3820 m alt., between Quenuarán and Pampachiri, May 1975, *C. Ochoa 9796*, 2n=48 (CIP, OCH). Chasqui Ckasa, 3890 m alt., May 1975, *C. Ochoa 9829*, 2n=48 (CIP, NY, OCH, US).

Province Antabamba: Jascana, 4200 m alt., 12 February1960, *C. Ochoa 2258* (OCH). Quehuinamarca, 3700 m alt., above Antabamba, 25 March 1972, *C. Ochoa 3290* (OCH). Anta-Anta, near Vito, 3700 m alt., 25 March 1972, *C. Ochoa 3293* (OCH). Huackentonniyoc, facing Ckallpapata, ca. 3900 m alt., about 10 km from Huaquirca and Solabayas, 15-22 May 1975, *C. Ochoa 9012*, 2n=48 (CIP, NY, OCH, US).

Province Aymaraes: San Francisco, in a middle altitude zone, 2950 m alt., before Chalhuanca, 25 May 1980, *C. Ochoa 13810A*, 2n=48 (CIP, OCH, US).

Province Cotabambas: Near the gorge of Pampa Ccasa, 4400 m alt., near the highest pass between Cotabambas and Tambobamba, 29 February 1980, *C. Ochoa 13685*, 2n=48 (CIP, NY, OCH, US).

Province Grau: Along the Lambrama-Chuquibambilla road, 3900 m alt., 22 February 1960, *C. Ochoa and P. López Camarena 2220* (OCH).

Department Arequipa

Province Arequipa: Canaguas, 4078 m alt., in alpine meadow, plants growing flat on ground, tubers up to 2 cm long, 21 February 1958, *D. S. Correll and E. E. Smith P178* (LL). Lagunillas, 4050 m alt., near km 79 along the Arequipa-Juliaca road, 8 March 1981, *C. Ochoa 14284*, 2n=48 (CIP, OCH). Lagunillas, 4100 m alt., between km 76 and 77 on the Arequipa-Juliaca road, 8 March 1981, *C. Ochoa 14285*, 2n=48 (CIP, OCH). Near Santa Lucía, 4000 m alt., km 60 of the Juliaca-Arequipa road, 8 March 1981, *C. Ochoa 14287*, 2n=48 (OCH).

Province Caylloma: Near the detour of the Sumbay-Chivay road, at the intersection of the Arequipa-Sibayo road, 4400 m alt., beyond Chasquipampa and Canahua, 29 March 1974, *C. Ochoa 5083* (OCH). Cerro Jayo, 4520 m alt., near the intersection of the Sumbay-Chivay and Arequipa-Sibayo roads, beyond Chasquipampa and Canahua, 29 March 1974, *C. Ochoa 5089* (OCH). Uplands of Utupara, 4500 m alt., in grassland, 31 March 1974, *C. Ochoa 5122* (CIP, NY, OCH, US). Pampas de Amarani, 4100 m alt., near the intersection of the Sumbay-Viscachani and Pulpera roads, 6 March 1981, *C. Ochoa 14266*, 2n=48 (OCH). Middle slopes of Cerro Yahuarmayo, facing Pulpera, 4000 m alt., among grasses, 6 March 1981, *C. Ochoa 14274*, 2n=48 (OCH). Vicinity of Viscachani, 4140 m alt., along the Chivey-Shibayo road, among large rocks, n.v. *"Apharu"*, 6 March 1981, *C. Ochoa 14276*, 2n=48 (OCH). Between Viscachani and the intersection toward Aguada Blanca, 4075 m alt., along the Arequipa-Shibayo road, among an extensive formation of "t'tolares" (*Lepidophyllum sp.*), associated with *Stipa ichu* on loose, rocky soil, 6 March 1981, *C. Ochoa 14277*, 2n=48 (CIP, OCH).

Province Condesuyos: Cayarani, 3900 m alt., n.v. *Atokk Papa*, May 1975, *C. Ochoa 8846* (CIP, OCH).

Department Ayacucho

Province Cangallo: About 38 km from Ayacucho on the road towards Andahuaylas, 3900 m alt., 17 April 1953, *Peterson and P. J. Hjerting 1409 and 1410* (= *PI-210032*, from living plants grown at Sturgeon Bay, Wis., USA). Licapa, *ca.* 3500 m alt., along the Vinchos-Ticrapo road, February 1975, *C. Ochoa 7348* (OCH).

Province Huamanga: Punas de Tocto, 4000 m alt., 19 January 1958, *O. Velarde 6306* (OCH). Punas de Tocto, 4160 m alt., February 1960, *OCH. S-39 = PI 365307* (from plants grown at Sturgeon Bay, Wis., USA). Mines of C'kuchu, 3900 m alt., near Chiara, May 1975, *C. Ochoa 10111* (CIP, OCH), *10112*, 2n=48 (CIP, NY, OCH, US), and *10113* (OCH). Apacheta, 4000 m alt., along the La Quinua-Tambo road, a few km from La Quinua, February 1979, *C. Ochoa 13192*, 2n=48 (OCH). Lower slopes of Cerro Condorcunca, 3600 m alt., near La Quinua, February 1979, *C. Ochoa 13193*, 2n=48 (OCH).

Province Huanta: Near the snow peak Razuwilca, 4000-4100 m alt., leaves pressed against the ground, flowers violet, February 1926, *Weberbauer 7501* (F, WIS).

Province Lucanas: 90 km from Nazca, on road to Puquio, 3900 m alt., on sand bar along streams, plants prostrate, flat on ground, flowers purplish blue, 14 February 1958, *D. S. Correll and E. E. Smith P154* (LL). On cumbre, near tip, about 117 km from Nazca on road to Puquio, 4500 m alt., plants appressed to ground, tubers small, 14 February 1958, *D. S. Correll and E. E. Smith P155* (LL).

Ogoron Pampa, 3550 m alt., along the Puquio-Andamarca road, plants growing in a space between large rocks, 15-20 March 1972, C. *Ochoa 3263* (OCH). Highlands in the vicinity of Lucanas, 4400 m alt., tubers collected in July 1975, C. *Ochoa 10979,* 2n=48 (CIP, OCH, US, from plants grown in the greenhouse at CIP-Huancayo). Condor Senkka, 4000 m alt., Pampa Galeras, April 1977, C. *Ochoa 11602,* 2n=48 (OCH) and (CIP, US, from plants grown at Universidad Nacional Agraria, La Molina, near Lima). Capitoy-Machucoptoc, 4000 m alt., Pampa Galeras, April 1977, C. *Ochoa 11603,* 2n=48 (CIP, NY, OCH, US). Rojroscca, 4200 m alt., 6 km from Negro Mayo, along the route towards Puquio, 26 March 1980, C. *Ochoa 13816* (OCH). San Miguel de Misticas, 4200 m alt., along the route Negro Mayo-Puquio, 26 March 1980, C. *Ochoa 13817,* 2n=48 (OCH). Pampa Marca, 4200 m alt., along the route Negro Mayo-Puquio, 26 March 1980, C. *Ochoa 13818,* 2n=48 (CIP, OCH, US). Santa Rita, 4300 m alt., along the Pampa Marca-Puquio road, collections of living plants only, berries and tubers, 26 March 1980, C. *Ochoa 13819* (OCH) and *13820,* 2n=48 (CIP, F. NY, OCH, US, from plants grown in the greenhouse at CIP-Huancayo). Highlands of Puquio, 3700 m alt., along the Pampa Marca-Puquio road, 26 March 1980, C. *Ochoa 13821,* 2n=48 (OCH). Vicinity of Puquio, 3750 m alt., 26 March 1980, C. *Ochoa 13823,* 2n=48 (CIP, OCH), and *13824,* 2n=48 (OCH). Pampaccara, 3800 m alt., between Lucanas and Pampa Galeras, 26 March 1980, C. *Ochoa 13831,* 2n=48 (CIP, OCH, US, from plants grown in the greenhouse at CIP-Huancayo). At km 172 on the Abancay-Puquio road, 4100 m alt., in grassland, 30 March 1981, C. *Ochoa 14389,* 2n=48 (CIP, NY, OCH, US, from plants grown in the experimental field at CIP-Huancayo). At km 183 on the Abancay-Puquio road, 4120 m alt., 30 March 1981, C. *Ochoa 14390,* 2n=48 (OCH). Near Negro Mayo, 4200 m alt., on the Abancay-Puquio road, near cattle corrals, 30 March 1981, C. *Ochoa 14391*, 2n=48, and *14392*, 2n=48 (OCH). Santa Rita, 3980 m alt., near Puquio, 30 March 1981, C. *Ochoa 14393,* 2n=48 (CIP, OCH, from plants grown in the greenhouse at CIP-Huancayo) and (OCH, from plants grown in the field). La Cabañita, 4000 m alt., near Puquio, 30 March 1981, C. *Ochoa 14394,* 2n=48 (CIP, OCH, US). At the beginning of the Pampa Galeras, 4000 m alt., sloping above the Puquio-Andahuaylas road, 30 March 1981, C. *Ochoa 14402,* 2n=48 (CIP, OCH, US, from plants grown in the fields at CIP-Huancayo). Administrative Complex of Breeding and Conservation of Vicuñas at Pampa Galeras, 3950 m alt., 30 March 1981, C. *Ochoa 14403,* 2n=48 (OCH).

Province Parinacochas: Cuncalla, above Occari lane, 3600 m alt., 15-20 April 1971, C. *Ochoa and A. Salas 2994* (OCH). Colloni, 3600 m alt., between Chumpi and Incuyo, between large rocks, 15-20 April 1971, C. *Ochoa and A. Salas 3000* (OCH). Salla-Salla, 3600 m alt., to the southeast of the lagoon of

Parinacochas, 15-20 April 1971, *C. Ochoa and A. Salas 3001* (OCH). Salla-Salla, 3600 m alt., to the southeast of the lagoon of Parinacochas, in the dry bed of the Ullacha River, 15-20 April 1971, *C. Ochoa and A. Salas 3002* (OCH). Between Incuyo and Salla-Salla, 3600 m alt., 15-20 April 1971, *C. Ochoa and A. Salas 3003* (OCH). Between Incuyo and Lampa, 3600 m alt., 15-20 April 1971, *C. Ochoa and A. Salas 3008* (OCH). Colloni, 3600 m alt., 15 March 1972, *C. Ochoa and A. Salas 3259* (OCH, US). Near Salla-Salla, 3800 m alt., distr. Incuyo, March 1984, *C. Ochoa 15369* (OCH). Near Colloni, distr. Puyuscca, towards the village east of the lagoon of Parinacochas, 3600 m alt., in the shade of a large rock, March 1984, *C. Ochoa 15370* (OCH).

Department Cusco

Province Acomayo: Sangarara, 3900 m alt., in grasslands near fields of *papas amargas,* 16 February 1980, *C. Ochoa 13623,* 2n=48 (CIP, OCH, US). Along the Pomacanchi-Toccorani road, distr. Pomacanchi, n.v. *Apharu-papa,*

February 1982, *R. Ortega 090* (OCH). Along the Pomacanchi-Conchaccalla road, *ca.* 4000 m alt., 1 February 1982, *R. Ortega 091* (OCH).

Province Anta: Huillque Pass, 3600 m alt., in grassy hillsides and sparse scrub, February 1946, *C. Vargas C. 5576* (CUZ).

Province Calca: In the vicinity of Lares, 3225 m alt., on talus slopes, January 1958, *C. Vargas C. 011904* (CUZ). Paru-Paru, 3890 m alt., in the highlands of Pisac, n.v. *Atokk-papa,* 12 May 1975, C. *Ochoa* 7990, 2n=48 (CIP, OCH, US). C'kellu P'puyto, 4200 m alt., between Chaiña Pass and Calca, near the mountain crest, 21 March 1980, *C. Ochoa 13794,* 2n=48 (CIP, OCH). Yanccaycalle, 4150 m alt., beyond Chaiña Pass on the Calca-Lares road, a short distance beyond the mountain crest, 14 March 1981, *C. Ochoa 14304* (OCH), *14305,* 2n=48 (OCH), and *14306,* 2n=48 (CIP, OCH). Yanccaycalle, near Chaiña, along the route Cusco-Amparaes by way of Calca, 4080 m alt., 14 March 1981, *C. Ochoa 14307,* 2n=48 (OCH). Ajcha, on the Calca-Amparaes road, 4100 m alt., 14 March 1981, *C. Ochoa 14314,* 2n=48 (OCH), and *14315* (OCH). Near the permanent snow line of Huaccaiwillca, between Palccayoc and Huaccaiwillca, 4300 m alt., growing near *Solanum bukasovii,* abundant between *Poa sp.* and *Stipa ichu,* 22 March 1981, C. *Ochoa 14356,* 2n=48 (CIP, OCH). Ranraccocha, 4100 m alt., distr. Lares, n.v. *Apharu-papa,* May 1985, *R. Ortega GPS-0127* (OCH). Ccohayoc-Chihuanano Huayckt'o, 4200 m alt., distr. Lares, n.v. *Apharu-papa,* May 1985, *R. Ortega GPS-0131* (OCH).

Province Canas: Checca, 26 February 1939, *C. Vargas C. 2005* (CUZ, K, type collection of *Solanum acaule* var. *checcae,* specimen K is from a plant grown at Cambridge, England). Checca, *CPC-537.6* (= *PI-205507*, received by the IR-1 Project, Sturgeon Bay, Wis., USA, 24 February 1953) and (CIP, from plants grown at CIP-Huancayo). Checca, along the left margin of the river, *ca.* 4000 m alt., near fields of cultivated potatoes, 15-18 March 1984, *C. Ochoa and O. Blanco 15678,* 2n=48 (CIP, OCH, US). Checca, near the local school, *ca.* 3850 m alt., 15-18 March 1984, *C. Ochoa and O. Blanco 15679* (CIP, OCH). Checca, *ca.* 3850 m alt., between rock walls at the entrance of the town, at the start of the Yanaoca-Checca road, 15-18 March 1984, C. *Ochoa and O. Blanco 15680* (CIP, OCH,US). Puente Asunción, 3800 m alt., near Checca, in grassland, about 60 m above the level of the Apurímac River, 15-18 March 1984, *C. Ochoa and O. Blanco 15684* (CIP, OCH, US). Chacarccata, *ca.* 4000 m alt., distr. Langui, among *Stipa ichu, Astragalus sp.* and *Medicago sp.*, April 1984, *R. Ortega CPS-0002,* 2n=48 (CIP, OCH) and (CIP,OCH, from plants grown in the greenhouse at CIP-Huancayo).

Province Canchis: Araranca, *ca.* 4100 m alt., hillside south of La Raya Pass, growing with cultivated potatoes, 12-13 April 1915, *O. F. Cook and G. B. Gilbert 180* (US), *181* (GH,NY,US), *182a* (US, WIS). Chuquibambilla, rocky place in *puna*, 3850-3900 m alt., 19-21 April 1925, *F. Pennell 13389* (F). Aguas Calientes, 4150 m alt., 11 April 1943, *C. Vargas C. 3315* (CUZ). Callachaca, small open slope, 3400 m alt., 26 December 1945, *C. Vargas C. 5506* (CUZ). About 30 km from Sicuani, on the road to Puno, 3950 m alt., 3 March 1953, *Peterson and J. P. Hjerting 1582* (= *PI-275129*, determined from living plants grown at Sturgeon Bay, Wis., USA). Halfway between Sicuani and La Raya Pass ESE of Marangani, about 8 km (rd.) WNW of Ocobamba, in field with corn and many potatoes intermixed, 8 January 1963, *H.H. Iltis and D. Ugent 1230* (OCH, US, WIS). La Raya Pass, 4250 m alt., 1 km WNW of La Raya on Cuzco road, associated with *Disticnia muscoides*, *Scirpus* and *Gentiana* in wet springy areas, 8 January 1963, *H.H. Iltis and D. Ugent 1260* (WIS). Aguas Calientes, 4050 m alt., just below La Raya Pass on Cuzco side of road from Cuzco to Puno, on banks by drainage ditches, mixed with *Solanum bukasovii* f. *multidissectum*, *puna* vegetation, 12 March 1974, *J.G. Hawkes, A.H. van Harten and J. Landeo 5488* (C1P). Aguas Calientes, 4000 m alt., near the railway station, growing with *Solanum bukasovii* and *S. raphanifolium*, 24 January 1980, C. *Ochoa 13541* (CIP, OCH). La Raya, *ca.* 4300 m alt., on the Puno-Cusco road, near cultivated land, between *Stipa ichu* and other grasses, April 1984, *R Ortega CPS-0048* (OCH).

Province Chumbivilcas: Ccolquemarca, ca. 3850 m alt., near Santo Tomás and Quiñota, 19 February 1979, C. Ochoa 13214, 2n=48 (OCH; from plants grown in the greenhouse at CIP).

Province Espinar: Puente Santo Domingo, 3890-4100 m alt., on stony hillsides, corolla blue, 7-9 February 1946, *C. Vargas C. 5647* (CUZ, LL). Mayuckahua, 3900 m alt., near Yauri, n.v. *Apharuma*, 21-24 May 1975, C. *Ochoa 8611*, 2n=48 (CIP, OCH, US, from plants grown in the greenhouse at CIP-Huancayo), and *8612* (CIP, OCH, US, from plants grown in the field at CIP-Huancayo). Puente

Santo Domingo, on the left side of the Yauri-Santo Tomás road, *ca.* 4000 m alt., growing with *Stipa ichu* and "pampa anise" in sandy soil, almost stony, dry, April 1984, *R. Ortega CPS-0007* (OCH). About 4 km from the Santo Domingo bridge, near Yauri, *ca.* 4000 m alt., on the left side of the Yauri-Santo Tomás road, amid *Stipa, Medicago* and *Astragalus,* April 1984, *R. Ortega CPS-0009* (CIP, F. NY, OCH, US, from plants grown in the greenhouse at CIP-Huancayo). Pinti, facing Phinaya, *ca.* 4000 m alt., on the right side of the Yauri-Santo Tomás road, about 30 km from the Santo Domingo bridge, in grasslands before the slope to the gorge, April 1984, *R. Ortega CPS-0010,* 2n=48 (CIP, OCH, US, from plants grown in the greenhouse at CIP-Huancayo). Cóndor Sayana, *ca.* 4000 m alt., about 45 km from the Santo Domingo bridge, on the left side of the Yauri-Santo Tomás road, between bunch grasses, April 1984, *R. Ortega CPS-0011,* 2n=48 (CIP, OCH, from plants grown in the greenhouse at CIP-Huancayo), and *CPS-0012* (OCH). On the ascent to Huaylla-Apacheta, *ca.* 4100 m alt., facing three cataracts, between the rock walls of corrals, April 1984, *R. Ortega CPS-0013,* 2n=48 (OCH) and (CIP, OCH, US, from plants grown in the greenhouse at CIP-Huancayo), *CPS-0014* (OCH), and *CPS-0015,* 2n=48 (CIP, OCH, US, from plants grown in the greenhouse at CIP-Huancayo). Tukamayo, Suycutambo, 3900 m alt., on the outskirts of Yauri, April 1984, *R. Ortega CPS-0017* (OCH). Paraccaya Pata, 3900 m alt., 2 km from Yauri on the Suycutambo road, between compact walls of adobe and in sandy, moist soil, April 1984, *R. Ortega CPS 0018* (OCH). Pararani, 3900 m alt., near Yauri along the Suycutambo-Yauri road, in a corral next to an adobe wall, April 1984, *R. Ortega CPS-0019* and *CPS-0021* (OCH). On talus slopes, on the right side of the Espinar-Tokroyok road, *ca.* 3950 m alt., in grassland, April 1984, *R. Ortega CPS-0036* (OCH). Km 20 on the Espinar-Tokroyok road, *ca.* 3950 m alt., near an irrigation ditch, in grassland, April 1984, *R. Ortega CPS-0039,* 2n=48 (CIP, OCH). Km 21 on the Espinar-Tokroyok road, *ca.* 4000 m alt., on adobe walls and amid *Stipa ichu,* on turbulent, moist soil, April 1984, *R. Ortega CPS-0040,* 2n=48 (OCH), and *CPS-0041 (CIP,* OCH, US, from plants grown in the greenhouse at CIP-Huancayo). Between km 25 and 30 on the Espinar-Tokroyok road, facing the community Huancane Alto, *ca.* 4000 m alt., amid *Stipa ichu,* April 1984, *R. Ortega CPS-0042* and *CPS 0044* (OCH). Cruzpampa, along the left side of the Tokroyok-Ayaviri road, *ca.* 4000 m alt., growing with "ruphu," "ichu" and "layo," in sandy soil, April 1984, *R. Ortega CPS 0045* (OCH). At kms 14 and 27, respectively, from Tokroyok, on the right side of the road leading to Ayeviri, *ca.* 4000 m alt., April 1984, *R. Ortega CPS-0046* and *CPS-0047* (OCH). Pockera, *ca.* 3900 m alt., distr. Yauri, n.v. *Apharuma,* May 1985, *R. Ortega GPS-0003* (OCH).

Province Paruro: Hacienda Ayusbamba, Cerro Sullkán, 3850 m alt., March 1938, *C. Vargas C. 1168* (CUZ). T'toccohuanca, 4000 m alt., distr. Paruro, n.v. *Atokk Papa,* May 1985, *R. Ortega GPS-0115* and *GPS-0116* (OCH).

Province Paucartambo: Ccolpapata, 3600 m alt., distr. Paucartambo, n.v. *Atokk Papa*, May 1985, *R. Ortega GPS-0006* and *GPS-0008* (OCH). Kallacancha, 3800 m alt., distr. Paucartambo, n.v. *Machocc Papan,* May 1985, *R. Ortega GPS-0012* (OCH).

Province Quispicanchis: Catcka, highlands of Kauri, 3700 m alt., in rocks, April 1937, *C. Vargas C. 972* (CUZ). Below Hualla Hualla Pass towards the Valley of Marcapata, 4300 m alt., in moist soil, December 1943, *C. Vargas C. 3749* (CUZ). Near Marcapata, 3200 m alt., April 1977, *C. Ochoa 11605,* 2n=48 (OCH).

Province Urubamba: Chicón, 4100-4400 m alt., 14 January 1951, C. *Vargas C. 10034* (CUZ). Trail behind Chincheros center, past Antasaka rock, place called Llaulliyoj, to spring called Parko, first kilometer out of population, aprox. 13°24' S, 72°3' W, plants by trailside, often in hedgerows, 12 January 1982, *W. Davis, E. Franquemont, C. Franquemont, S. King and C. Sperling 1353* (F).

Department Huancavelica

Province Huancavelica: Ocopampa, 4100 m alt., between Laria and Tambopata, distr. Conaica, in *puna* grass, 26 March 1952, *O. Tovar 836* (LL, OCH). Casablanca, 4000 m alt., 10 km from Huancavelica on the road to Lircay, between grasses and rocks, 16 March 1974, *J. Aguilar s.n.* (CIP). Km 75 of the Huancavelica-Iscuchaca road, *ca*. 3950 m alt., 11 February 1979, C. *Ochoa 13172*, 2n=A8 (CIP, OCH, US). Llullupata, 4100 m alt., at km 15 on the Huancavelica-Lircay road, 12 February 1979, *C. Ochoa 13175* (CIP, OCH).

Department Huánuco

Province Dos de Mayo: Lacuitanta, 3750 m alt., near Chavinillo, May 1972, *C. Ochoa 3644* (OCH). Algaihuachanan, 3700 m alt., near Pariapampa, past Chavinillo, May 1972, *C. Ochoa 3646* (OCH).

Province Huamalíes: Luichucancha, 3500-3700 m alt., near Tantamayo, in and between rocks, 1 May 1961, *C. Ochoa 2372* (OCH) and *3645* (OCH, from plants grown in the fields of the Universidad Nacional Agraria La Molina, near Lima, propagated in May 1972). Puna de Tayarajra, 4100 m alt., above Tantamayo, 25 April 1967, *C. Ochoa 2640* (OCH). Highlands of Cashupata, 3900 m alt., facing Jacas Grande, 27 April 1967, *C. Ochoa 2650A* (OCH, from plants grown from tuber-seed at San Mateo, 3450 m alt., near Lima). Slopes beneath Cerro Huanca, 3760 m alt., distr. Jacas, May 1972, *C. Ochoa 3650* (OCH, from plants grown at Granja K'ayra, 3250 m alt., Cusco, 1973).

Province Huánuco: Highlands of Jacas Chico, 3450 m alt., between Huancapallac and Huayaipite, on the Huánuco-Chavinillo road, flowers blue, berries round, also collected with mature berries, April 1967, C. *Ochoa S-55*, 2n=48, *PI-365309* (OCH).

Department Junín

Province Concepción: Highlands of Concepción, on the Concepción-Satipo road, 3800 m alt., March 1975, *C. Ochoa 7363* (OCH).

Province Huancayo: Pampacocha, ca. 3900 m alt., April 1947, C. *Ochoa 109* (OCH).

Province Jauja: Incacctiacunan, 4000 m alt., on the Jauja-La Oroya road, by way of Lomo Largo, in *puna* grassland, March 1948, C. *Ochoa 309* (MOL, OCH). Pachakkakka, 4000 m alt., in high grassland, 15 March 1960, D.S. *Correll and E.E. Smith P725* (LL). High grassland, km 34 on road between Jauja and Tarma, 4100 m alt., fruits dull green, ovoid, 2 cm long, 17 March 1960, *D.S. Correll and E.E. Smith P751* (LL).

Province Junín: Cima, 4000 m alt., Pampa de Junín, between Carhuamayo and La Oroya, 20 April 1980, C. *Ochoa 13872*, 2n=48 (CIP, OCH). Tambo Viejo, 3950 m alt., between tufts of *Stipa ichu*, March 1987, C. *Ochoa and A. Salas s.n.* (OCH). Pampa de Junín, 4200 m alt., without date of collection, C. *Ochoa s.n. = PI-186176*, 2n=48 (LL, from plants grown at Sturgeon Bay, Wis., USA).

Province Tarma: Casarajra, 3850 m alt.,15 km from La Oroya on the road to Junín [?], 9 April 1953, *Peterson and J.P. Hjerting 1341 = PI-210031* (US, from plants grown at Sturgeon Bay, Wis., USA). Near the road fork on the La Oroya-Carhuamayo road, on the route to San Pedro de Cajas, 3800 m alt., 20 April 1980, *C. Ochoa 13873*, 2n=48 (OCH). Casarajra, 3850 m alt., 27 January 1984, *C. Ochoa 15301*, 2n=48 (OCH).

Province Yauli: 20 km south of La Oroya, in pampa, 27 November 1937, *H.L. Blood and L. Tremelling 34* (NA). Otuto, 4000 m alt., above Chacapalpa, between *puna* grasses, in sandy-rocky soil, flowers blue, 23 January 1948, C. *Ochoa 271* (LL, OCH). Near Chacapalpa, 3800-3900 m alt., in *puna*, March 1953, C. *Ochoa 2025* (OCH). Above the cemetery at Huaymanta, 3600 m alt., near La Oroya, 24 March 1977, C. *Ochoa 11336*, 2n=48 (OCH). Huaymanta, 3600 m alt., near La Oroya, n.v. *Papa de Perdiz*, April 1977, C. *Ochoa 11604*, 2n=48 (OCH). Pucapua, 3950 m alt., above Chacapalpa, 31 January 1978, C. *Ochoa 11867*, 2n=48 (OCH). Above Huaymanta, 3700 m alt., 22 January 1979, C. *Ochoa 13109* (OCH). Pucará, near La Oroya, 3800 m alt., 27 January 1984, C. *Ochoa 15300*, 2n=48 (OCH).

Department Lima

Province Cajatambo: Near Chanca mine, on the Cajatambo-Oyón road, about 25 km from Cajatambo, 4500 m alt., distr. Gorgor, 31 January 1979, *C. Ochoa and A. Salas 13145* (CIP, OCH, US). Quinchas, 4100 m alt., about 26 km from Oyón on the Oyón-mina Raura road, 31 January 1979, *C. Ochoa and A. Salas 13146* (CIP, OCH). Km 2 west of Quichas, 4100 m alt., on the Oyón-mina Raura road, 31 January 1979, *C. Ochoa and A. Salas 13149* (CIP, OCH, US). Quinanhuay, ca. 3800 m alt., 8 km west of Oyón, tubers infected by *Synchytrium endobioticum*, 31 January 1979, *C. Ochoa and A. Salas 13151* (OCH).

Province Canta: On open mountain slope above Culluay, 4050 m alt., low rosette plants, flowers blue, fruits ovoid, tubers small, round or ellipsoid, 7 March 1958, *D.S. Correll, E.E. Smith and R. Ferreyra P298* (LL). Lachaqui (*toma*), 3800 m alt., In quebradas near cultivated fields of alfalfa, plants rosette-like, flowers purple, n.v. *Papa Shoco,* May 1973, *G. Vilcapoma 132* (OCH, USM). Lachaqui, 3650 m alt., on mountain slopes in stony soil, flowers blue, *n.v. Papa Shoco,* 18 March 1973, *G. Vilcapoma 145* (OCH, USM). Cerro Champacra, Lachaqui, 3850 m alt., in grassland, flowers blue-purple, 9 February 1974, *G. Vilcapoma 195* (CIP, F. NY, OCH, US). North of Lachaqui, 3800 m alt., in grassland, on land fertilized by cow dung, flowers blue-purple, 10 February 1974, *G. Vilcapoma 196* (CIP, F. NY, OCH, US). Agua Bendita, Lachaqui, 3750 m alt., in grassland, on rocky, moist hillsides covered abundantly with moss, 10 February 1974, *G. Vilcapoma 197* (OCH). Cerro Quinán, Lachaqui, 4000 m alt., in *puna*, flowers purple, n.v. *Papa Shoco,* 16 March [February ?] 1974, *G. Vilcapoma 195-B* (CIP, NY, OCH, US). Huaros, 4000 m alt., ascent to Jara, n.v. *Shiri,* 11 March 1977, *C. Ochoa 11304,* 2n=48 (OCH).

Province Huarochirí: Rio Blanco, disintegrated granite slope, 4570 m alt., 20-25 March 1923, *J. Francis MacBride 3017* (F). Surroundings of Chicla, 3700-3750 m alt., between San Mateo and Casapalca, plants appressed to the soil, 27 January 1950, *R. Ferreyra 6531* (USM). Pacomanta, 3760 m alt., on the Lima-Huarochirí road, 15 April 1974, *C. Ochoa 5223* (OCH). Near Chicla, 3750 m alt., in poor sandy-rocky soil, March 1975, *C. Ochoa 7435* (OCH). Near Huarochirí, 3750 m alt., on the Pachacosa-Huarochirí road, 21 March 1977, *C. Ochoa 11320,* 2n=48 (CIP, OCH), *11322* (CIP, OCH, US) and *11324,* 2n=48 (OCH). Between Millioc and Marcapomacocha, 4200 m a1t., at the base of great rocky cliffs with *Solanum bukasovii,* between *Stipa ichu*, on soil spread with abundant cow dung, 16 February 1979, *C. Ochoa 13180,* 2n=48 (CIP, F, NY, OCH, US). Bellavista, *ca.* 4000 m alt., between Chicla and Casapalca, February 1982, *C. Ochoa 14519,* 2n=48 (CIP, OCH). Highlands of Pacomanta, 3900 m alt., on the Lima-Huarochirí road, March 1982, C. *Ochoa 14615*, 2n=48 (OCH), *14616*, 2n=48 (OCH), and *14617*, 2n=48 (CIP, OCH, US). Chicla, 4000 m alt., distr. San Matero, 4 May 1982, *C. Ochoa 14749*, 2n=48 (OCH).

Province Yauyos: Between Pallca and Huacracocha, 4200 m alt., *puna*, about 15 km from Tupe, n.v. *Aya Papa*, flowers blue, 22 January 1952, *E. Cerrate 1259* (OCH, USM). Between Pallca and Huacracocha, 4200-4300 m alt., flowers blue, 22 January 1952, *O. Tovar 255* (LL).

Department Pasco

Province Pasco: Hacienda Andachaca, 4200 m alt., between bunch grasses, about 60 km from Cerro de Pasco, plants with rosettes10-15 cm in dia., with abundant fruits (6-8), flowers small, blue, on loose black soil, 21 January 1947, C. *Ochoa 16* (OCH). Near Tambo del Sol, 4150 m alt., to the south of Ninacaca and upto the northern part of pampa de Junín, between tufts of *Stipa ichu*, plants rosette-like, flowers blue, n.v. *Jupaypa Papan* (=Devil Potato), 22 March 1951, C. *Ochoa 1129* (OCH). Gloriapata, 3900 m alt., distr. Pampania, 4 March 1977, C. *Ochoa and A. Salas 11296*, 2n=48 (OCH). Guanuni, above La Victoria, 4000 m alt., on the Carhuamayo-Paucartambo road, in grassland on the mountain slopes, 28 January 1978, C. *Ochoa 11860*, 2n=48 (CIP, OCH, from plants grown in the experimental field at CIP-Huancayo). La Victoria, 4100 m alt., on the Carhuamayo-Paucartambo road, 20 April 1980, C. *Ochoa 13864* and *13865*, 2n=48 (CIP, OCH). Capilla, 4200 m alt., between stone walls of a cattle corral, on the Carhuamayo-Paucartambo road, 20 April 1980, C. *Ochoa 13868*, 2n=48 (CIP, OCH). Near the fork of the Carhuamayo-Paucartambo road to Ulcumayo, 4000 m alt., between cattle corrals, 20 April 1980, C. *Ochoa 13869*, 2n=48 (CIP, OCH), and *13870*, 2n=48 (CIP, OCH). Huayllay, 4200 m alt., near Bosque de Piedras, on the Carhuamayo-Cerro de Pasco road, between tufts of *Stipa ichu*, 20 April 1980, C. *Ochoa 13871*, 2n=48 (CIP, OCH). Two km before La Victoria, *ca.* 3800 m alt., on the Carhuamayo-Paucartambo road, in *puna* grassland, 1 May 1983, C. *Ochoa and A. Salas 15199*, 2n=48 (CIP, OCH). Between Carhuamayo and Colquijirca, Pampa de Junín, 4000 m alt., January 1984, C. *Ochoa 15303*, 2n=48 (CIP, OCH, from plants grown in the greenhouse at CIP-Huancayo).

Department Puno

Province Azángaro: Between Crucero and Aricoma, 4300 m alt., on the road to Macusani, in grassland, 11 March 1981, C. *Ochoa 14294*, 2n=48 (CIP, OCH). Ckenamari, 4100 m alt., at km 59 on the Puno-Macusani road, between Crucero and Aricoma, 11 March 1981, *C. Ochoa 14295, 2n=48* (C1P, F, NY, OCH, US). Between Ananea and Putina, 4000 m alt., near the right bank of the

Condorami River, 19 February 1983, C. *Ochoa 15093*, 2n=48 (OCH), *15094*, 2n=48 (CIP, OCH, from plants grown at CIP-Huancayo), *15095*, 2n=48 (OCH), and *15096*, 2n=48 (CIP, OCH). Along the Asillo-Puno road, *ca*. 3850 m alt., C. *Ochoa s.n.* (OCH).

Province Carabaya: Hacienda Macusani, Lacka, 4450 m alt., 2 January 1948, *C. Vargas C. 7023* (LL). Rumi-Rumi, 4000 m alt., between Macusani and Ollachea, on hillside grasslands and between large rocks, 5 April 1974, *C. Ochoa 5142* (OCH). Ascent to Ocke Puño Pass, 4700 m alt., 5 April 1974, *C. Ochoa 5153* (OCH). Ccackeni, 4000 m alt., about10 km before Macusani, ascending to Ollachea via the route Juro Juro, inside of a cattle corral, 18 February 1983, C. *Ochoa 15078*, 2n=48 (CIP, OCH). Pacajes, 4200 m alt., distr. Macusani, n.v. *Arakk Papa*, May 1985, *R. Ortega GPS-00199* (OCH). Tantamaco, 4100 m alt., distr. Macusani, n.v. *Arakk Papa,* May 1985, *R. Ortega GPS-0021* (OCH).

Province Chucuito: Crevice of cliff near Camacani, 27 km southeast of Puno, 4100 m alt., plants flat on ground, flowers purplish, 23 February 1958, *D.S. Correll and E.E. Smith P214* (LL). Near Chucuito, 3840 m alt., a little less than 1 km from Lago Titicaca, 25 February 1978, C. *Ochoa and A. Salas 11887*, 2n=48 (OCH). Near Acora, 3840 m alt., between Chucuito and Juli, 25 February 1978, C. *Ochoa 11889*, 2n=48 (OCH; in laboratory investigations made at CIP, this collection showed immunity to PVX). Near Juli, 3825 m alt., plants caulescent, between adobe walls, near large tufts of *Stipa ichu*, 25 February 1978, C. *Ochoa 11890*, 2n=48 (CIP, OCH). Pomata, 3850 m alt., plant rosettes 10-15 cm in dia., with 6-8 oval fruits per plant, 25 February 1978, C. *Ochoa 11891*, 2n=48 (CIP, OCH). Near Juli, 3825 m alt., between fields of cultivated potatoes, 27 January 1980, C. *Ochoa 13554*, 2n=48 (CIP,OCH, from plants grown in the greenhouse at CIP-Huancayo).

Province Huancané: Mines at San Antonio, Puno, 4200 m alt., March 1943, C. *Sandeman 3933* (K). Chakko-Uyo, 3820 m alt., in the partiality of Ckuchu Amaru, near Huancané, pedicels 15-20 mm long, fruits ovate-conical, 1 April 1978, *C. Ochoa 12037*, 2n=48 (CIP, OCH). Pejosiri, 3860 m alt., near Huancané, between large tufts of *Stipa ichu,* fruits ovate-conical, 1 April 1978, C. *Ochoa 12038*, 2n=48 (OCH). Between Huancané and Cojata, 2 km before Cojata, 4355 m alt., between bunch grasses, 3 February 1983, *C. Ochoa 14926*, 2n=48 (CIP, OCH), *14927*, 2n-48 (OCH), *14928*, 2n=48 (CIP, OCH), and *14929*, 2n=48 (OCH). Laccota, 4000 m alt., between Cojata and the intersection of the Checkepampa road, 3 February 1983, *C. Ochoa 14930,* 2n=48 (OCH), *14931*, 2n=48 (CIP, OCH), *14932*, 2n=48 (OCH), *14933*, 2n=48 (CIP, OCH), *14934*, 2n=48 (CIP, OCH), *14935*, 2n=48 (OCH), *14936*, 2n=48 (OCH), *14937*, 2n=48 (OCH), *14938* (OCH), *14939* (OCH) and *14940* (OCH). Two km before Laccota, on the road to Cojata toward the intersection of the Checkepampa road, 4000 m alt., 3 February 1983, C. *Ochoa 14941* (OCH), *14942* (OCH), *14943* (OCH) and *14944*, 2n=48 (OCH).

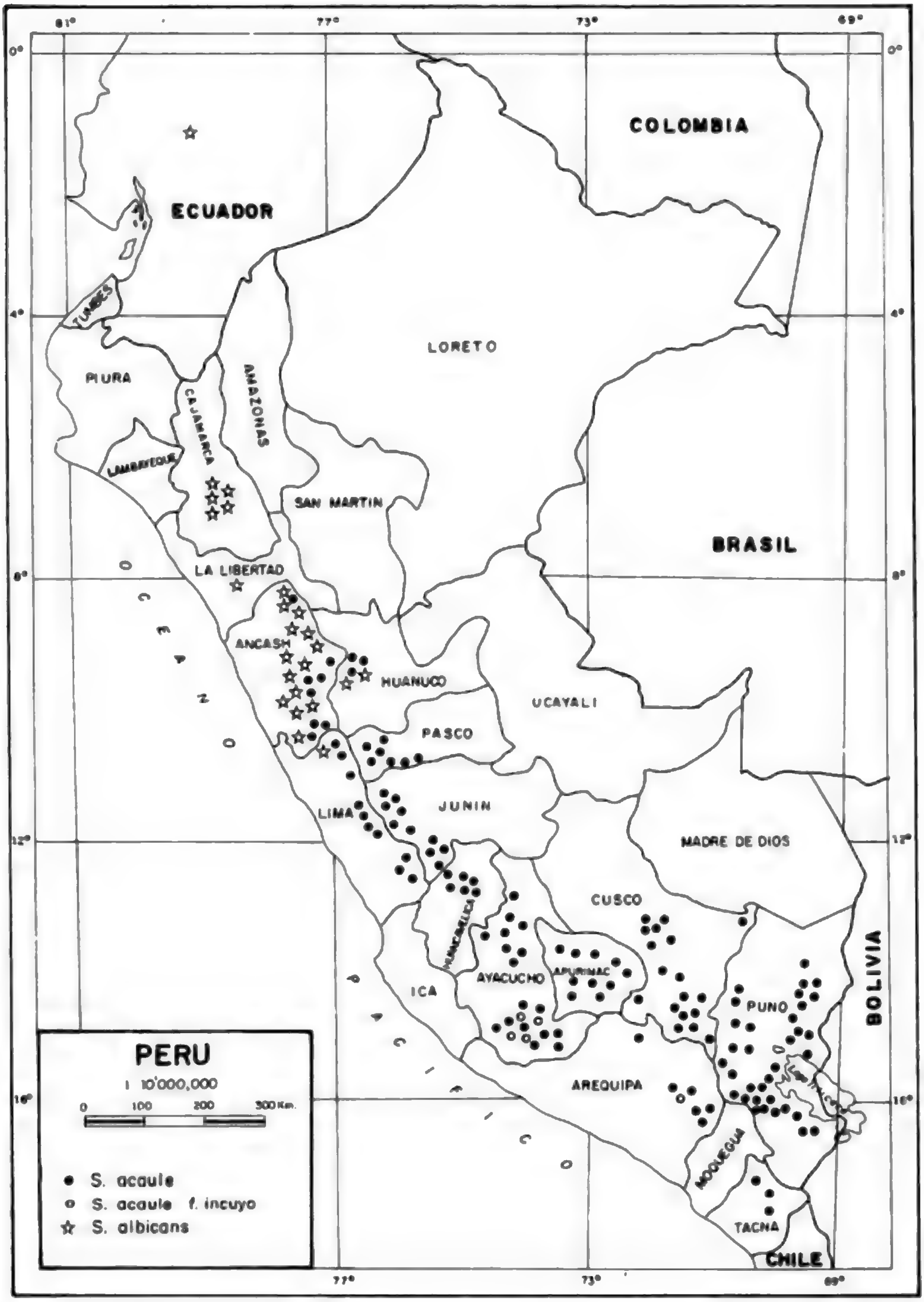
Province Lampa: Santa Lucía, the pampa, 4260 m alt., 22 January 1940, *J.E. Sharpe 120* (K). Muñani, 4150 m alt., between rocks, March 1949, C. *Vargas C. 8271 p.p.* (LL, plant 1= *S. acaule*, plant 2= S. *megistacrolobum* var. *toralapanum*). Limón Verde, Santa Lucía, *ca.* 3900 m alt., Lampa Mine, 13 January 1963, *H.H. & C.M. Iltis and D. & V. Ugent 1417* (US, WIS). Lago Jaracocha, 4000 m alt., 9 km SW of Santa Lucía, on bare soil, railroad and road sides with *Myriophyllum, Elodea, Calitriche, Limosella, Zanichellia, Potamogeton* and *Lilaea*, 12 January 1963, *H.H. & C.M. Iltis and D. & V. Ugent 1435* (OCH, US, WIS). Cabanillas, 3870 m alt., 6 April 1974, C. *Ochoa 5204* (OCH). Saluyo, 3900 m alt., between Pucara and Ayaviri, near km 110 of the Puno-Cusco road, in grassland, loose clay, 10 March 1984, C. *Ochoa 15621*, 2n=48 (OCH). Saracocha, 4100 m alt., near km 74 of the Juliaca-Arequipa road, distr. Santa Lucía, 22 March 1984, C. *Ochoa 15670* and *15671* (OCH). Quimsachaca, 4200 m alt., at km 75 of the Juliaca-Arequipa road, 22 March 1984, C. *Ochoa and A. Salas 15672 and 15673* (OCH). Tingo Palpa, 4200 m alt., at km 107 on the Juliaca-Arequipa road, 22 March 1984, C. *Ochoa and A. Salas 15674 and 15675* (OCH).

Province Melgar: 1/2 km SE of Hacienda Santa Rosa de Achaco, 3800 m alt., *ca.* 12 km E (by Ñuñoa road) from Santa Rosa, 4000 m alt., in rocky, arid, grazed *puna* grassland slopes with large colony of *Puya raimondi*, many lichens and ferns, also *Ranunculus, Carex, Gentiana* and *Poa*, 9 January 1963, *H.H. Iltis and D. Ugent 1299* (WIS). In the vicinity of Santa Rosa, *ca.* 3900 m alt., 24 January 1980, C. *Ochoa 13519*, 2n=48. Between Ccaccachupa and Jaillani, 4200 m alt., near La Raya Pass, between Santa Rosa and La Raya, on the Puno-Cusco road, in *puna*, abundant at the base of the stone walls of cattle corrals, associated with *Solanum bukasovii, Cajaphora, Stipa, Poa* and *Ranunculus*, 24 January 1980, C. *Ochoa 13520*, 2n=48 (CIP, OCH), and *13521* (CIP, OCH). Between Ccaccachupa and Jaillani, 4200 m alt., on the Santa Rosa-La Raya road, 24 January 1980, C. *Ochoa 13522*, 2n=48 (OCH). Picjchu, between Kunurana and Santa Rosa, *ca.* 3950 m alt., on the course from Santa Rosa to La Raya Pass on the Puno-Cusco road, 24 January 1980, C. *Ochoa 13531A*, 2n=48 (CIP, OCH, from plants grown at CIP-Huancayo). Achacumayo, 3980 m alt., between Ayaviri and Santa Rosa, near km 174 of the Puno-Cusco road, in *puna*, associated with *Stipa ichu*, in very moist black soil, 11 March 1984, C. *Ochoa 15622*, 2n=48 (CIP, OCH). Unta, 4100 m alt., near km 102 of the Puno-Cusco road, between Santa Rosa and La Raya Pass, 11 March 1984, C. *Ochoa 15626* (OCH).

Province Puno: 13 km from Puno on the road to Tingopalca, 4200 m alt., 10 March 1953, *Peterson, J.P. Hjerting and Reche 1076* (OCH). 75 km from Puno, between Puno and Tingopalca, 4500 m alt., 10 March 1953, *Peterson, J. P. Hjerting and Reche 1079* (OCH). Cabrasillo, 3800 m alt., near Puno on the road to Juliaca, between large stones, associated with *Solanum bukasovii*, *Stipa ichu* and large colonies of *Lobivia* sp., 16 March 1953, *C. Ochoa 2031* (GH, OCH). Near Camacani, 27 km southeast of Puno, crevices of cliffs, 4100 m alt., 23 February 1958, *D.S. Correll and E.E. Smith P124* (LL). Lagunillas, 4300 m alt., in alpine meadow, plants low and completely appressed to ground, flowers blue, 21 February 1958, *D.S. Correll and E.E Smith P179* (LL). Maravillas, 3900 m alt., along river meadow edge, plant low and bushy, fruit ovoid, grass-green with darker green patches, 2 cm long, 21 February 1958, *D.S. Correll and E.E. Smith P180* (LL). 6 km from Puno on road to Arequipa, 4000 m alt., among boulders in disturbed soil, plants growing flat on ground, 22 February 1958, *D.S. Correll and E.E Smith P181* (LL). 4 km from Puno on road to Arequipa, 3900 m alt., growing in shelter of rock wall or in open rocky soil, flowers purple, rotate, 22 February 1958, *D.S. Correll and E.E. Smith P191 and P192* (LL). Pampa de Vilque at km 30 on Puno road ca. 3 km SE of Vilque, 3750 m alt., roadside, 11 de January 1963, *H.H. & C.M. Iltis and D. & V. Ugent 1351* (US, WIS). Village of Vilque, 23 km WNW of Puno, 3950 m alt., on bare clay soil bank and open field, 11 January 1963, *H.H. & C.M. Iltis and D. & V. Ugent 1379* (OCH, US, WIS). Km 50 on Puno-Arequipa road W of Puno, in small valley, 6 km SW of Mañazo, 3800 m alt., 11 January 1963, *H.H. Iltis and D. Ugent 1388* (OCH, US, WIS). Acora, 3810 m alt., 33 km SE of Puno, growing on top of a low adobe wall in rocky soil, 28 March 1963, *D. and V. Ugent 4549 and 4551* C(WIS). Unta, 3820 m alt., 6 April 1974, *Ochoa 5203* (OCH). Near the archaeological ruins of Sillustani, 3900 m alt., near Puno, small colony growing on a hill, 25 March 1979, *S. Keel K488,* 2n=48 (OCH). Cerro Pitiquillani, Granja Salcedo, 3850 m alt., near Puno, in gravel soil, very poor, with *Solanum bukasovii* and *S. megistacrolobum*, 26 January 1980, *C. Ochoa 13545*, 2n=48 (CIP, OCH, from plants grown in the greenhouse at CIP Huancayo). Cuturati, 3820 m alt., on the Puno-Chucuito road, in stony or gravely soil, very poor, in full flower, growing near *Solanum bukasov*ii, 27 January 1980, *C. Ochoa 13547*, 2n=48 (OCH). Between Ilave and Phiñutani, 3840 m alt., on the Ilave-Puno road, associated with *Plantago, Poa, Stipa* and *Alternanthera*, 27 January 1980, *C. Ochoa 13555*, 2n=48 (CIP, OCH). At km 7 of the Puno-Juliaca road, 3800 m alt., abundant, 27 January 1980, *C. Ochoa 13561*, 2n=48 (CIP, OCH). Illpa, 3900 m alt., above the house of the hacienda, protected by shrubs of *Chuquiraga* sp., 9 March 1984, *C. Ochoa 15613*, 2n=48 (CIP, OCH), and *15614*, 2n=48 (CIP, OCH, US).

Province Sandia: Vicinity of the Suitu Cocha lagoon, 4000 m alt., above Cuyo Cuyo, on the Cuyo Cuyo-Juliaca road, February 1983, *C. Ochoa 15059*, 2n=48 (CIP, OCH, US), *15060* (OCH), *15061*, 2n=48 (OCH), *15062*, 2n=48 (OCH), and *15063*, 2n=48 (OCH). Between *chulpas* or pre-Inca cemeteries of Machuticani, 3800 m alt., near the pass of the old Patambuco-Sandia road, 19 February 1983, *C. Ochoa 15083*, 2n=48 (OCH). Apacheta de Patambuco, on the Patambuco-Juliaca road, 4000 m alt., 19 February 1983, *C. Ochoa 15086*, 2n=48 (CIP, OCH), *15087*, 2n=48 (OCH), and *15089*, 2n=48 (OCH). Solitario, 4200 m alt., in cattle corrals of the altiplano between Suitu Cancha and Tambillo, on the Puno-Sandia road, 19 February 1983, *C. Ochoa 15088*, 2n=48 (OCH), *15090*, 2n=48 (OCH), *15091*, 2n=48 (CIP, OCH), and *15092* (OCH). Solitario, 4200 m alt., near km 164 of the Juliaca-Sandia road, in *puna* grassland, 8 March1984, *C. Ochoa 15608* (CIP, OCH, US), *15609*, 2n=48 (CIP, OCH, US), *15610* (CIP, OCH, US) and *15611*, 2n=48 (CIP, OCH, US). Huancarani, 4000 m alt., about 8 km from Limbani, on the Limbani-Aricoma Pass road, in very poor moist soil, 5 March 1984, *C. Ochoa 15604*, 2n=48 (CIP, OCH, US). Lahuania, 4100 m alt., about 13 km from Limbani, on the Limbani-Aricoma Pass road, inside a corral on soil covered with abundant cow manure, 5 May 1984, *C. Ochoa 15605*, 2n=48 (CIP, OCH, US).

Province San Román: Juliaca, meadows, 3800 m alt., 6 February 1937, *D. Stafford 431* (K). Hacienda Tincopalca, 4200 m alt., 3 March 1953, *Peterson and J. P. Hjerting 1086 (= PI-210033)*, (CIP, from plants grown at CIP-Huancayo, 29 January 1969, and LL, from plants grown at Sturgeon Bay, Wis., USA, 6 September 1955). Above La Escalera, 4450 m alt., 143 km from Arequipa on road to Puno, 70°45' W, 15°55' S., in wet high *puna*, rich damp soil by stream at base of large rocks, 9 January 1971, *J.G. Hawkes, J.P. Hjerting, P.J. Cribb and Z. Huamán 4114* (CIP). Yocara, 3750 m alt., near Juliaca, in poor gravel-clay soils, with caespitose bunches of *Lobivia* sp., March 1979, *C. Ochoa 13242*, 2n=48 (OCH). Tico Tico, 4250 m alt., at km 154 of the Juliaca-Arequipa road, near cattle corrals, 8 March 1981, *C. Ochoa 14278*, 2n=48 (CIP, OCH, US). Pati, 4180 m alt., on the Juliaca-Arequipa road, in *puna*, between large rocks and tufts of *Stipa ichu*, 8 March 1981, *C. Ochoa 14279*, 2n=48 (CIP, OCH, US). Alto Toroya, 4200 m alt., between km 119 and 120 of the Juliaca-Arequipa road, in *puna* grassland, 8 March 1981, *C. Ochoa 14280*, 2n=48 (CIP, OCH, US). Ascending to Tincopalca, 4050-4100 m alt., between km 109 and 111 of the Juliaca-Arequipa road, in *puna*, 8 March 1981, *C. Ochoa 14281*, 2n=48 (CIP, OCH, US), *14282*, 2n=48 (CIP, OCH, US, from plants grown in the greenhouse at CIP-Huancayo). At km106 of the Juliaca-Arequipa road, 4000 m alt., near Tincopalca, 8 March 1981, *C. Ochoa 14283*, 2n=48 (CIP, NY, OCH, US). Saracocha, near Lagunillas, 4000 m alt., at km 89 of the Juliaca-Arequipa road, 8 March 1981, *C. Ochoa 14286*, 2n=48 (OCH).



Map 4. Distribution of *Solanum acaule*, *S. acaule* f. *incuyo* and *S. albicans*.

Department Tacna

Province Tarata: Tarata, 2100 m alt., 5-6 March 1950, *C. Vargas C. 9262* (CUZ). Peña Plaza, 3950 m alt., above Chivatería, near the Livine Pass, on the Tarata-Puno road, 22 March 1953, *C. Ochoa 2045* (OCH). 5 km northeast of Candarave, ca. 3240 m alt., facing Volcán Yucamani, in poor clay-sand-gravel soil, 4 March 1981, *C. Ochoa 14258*, 2n=48 (OCH). Tiricucho, near Candarave, 3240 m alt., 4 March 1981, *C. Ochoa 14259*, 2n=48 (CIP, OCH). Between Tacalaya and Laguna Suches, 3450 m alt., 4 March 1981, C. *Ochoa 14264*, 2n=48 (CIP, OCH, US).

Breeding Potential

The extremely short and generally inserted style of *S. acaule*, plus the early maturation of its pollen, makes this tetraploid species (2n=48) essentially cleistogamous, facilitating its extraordinary capacity to produce great quantities of self-fertilized berries. Therefore, in our experimental crosses involving this species, it was necessary to emasculate the flowers in the bud stage, i.e. even before they opened. However, even with this precaution there were some cases of autofertilization, and some of the berries had to be discarded.

Although *S. acaule* shows 24 chromosome bivalents at meiosis, in artificial crosses with diploid species the F_1 progeny exhibit largely trivalents, with few univalents.

Reciprocal crosses of *S. acaule* (EBN=2) with such wild diploid species (EBN=2) as *S. bukasovii*, *S. chomatophilum* and *S. sogarandinum* were accomplished fairly easily (see Tables 1 and 2). However, crosses with *S. megistacrolobum* were more difficult. It should be pointed out that all future investigations on the origin of *S. acaule* should include *S. bukasovii*, since, from the standpoint of phylogeny, this species appears to be closest to *S. acaule*.

In the great majority of hybrid swarms of these crosses, and particularly in those having either *S. raphanifolium* or *S. sogarandinum* as one of the F_1 parents, the dominance of *S. acaule* was noted in the form and shape of the corolla, but not in the articulation of the pedicel, which was always prominent. On the other hand, in hybrids of *S. megistacrolobum*, the genes of the latter appear to be absolutely dominant.

F_1 populations of *S. acaule* and *S. sogarandinum* show remarkable similarity to *S. albicans*, a fact suggestive of the possible ancestry of this species. The same is not true of F_1 hybrids of *S. acaule* and *chomatophilum*, which have a preponderance of dominant genes from *S. chomatophilum*, especially with regard to plant habit and flower and leaf shape. Significantly, both *S. sogarandinum* and *S. chomatophilum* are known to occur with *S. acaule* in nature, principally in the Province of Recuay, Department of Ancash, in northern Peru.

One particularly important result obtained in crosses of *S. acaule* with the cultivated species *S. goniocalyx* (*cv. tumbay*) is that self-compatible tetraploid plants are obtained.

Solanum acaule has immense potential as a source of genes for potato improvement. Apparently, few if any barriers to crossability exist between *S. acaule* and the wild diploid species of EBN=2 (see Table 1). This species, however, may be of less value in EBN=4 crosses involving *S. tuberosum* subsp. *andigena*. From the breeding standpoint, the various ploidy levels resulting from such crosses, with few exceptions, are easily handled.

Finally, it should be mentioned that the crosses of *S. acaule* (4x) with *S. albicans* (6x) were accomplished with great difficulty.

Additional information on the crossability of *S. acaule* is given in Hawkes and Hjerting (1989, p. 194) and Ochoa (1990, pp. 41-45).

1a. *Solanum acaule* Bitt. f. *incuyo* Ochoa, Phytologia 77(5):390, 1994.

Fig. 9; Map 4.

Plant rosette-like, sparsely pilose. Leaves imparipinnate, little divided to simple at the base, with (0-)1-3(-4) pairs of leaflets, without interjects; terminal leaflet much larger that the laterals, broadly elliptic-lanceolate to ovate-lanceolate or somewhat rhombic-lanceolate; apex obtuse, base broadly cuneate and decurrent; lateral leaflets small, sessile and broadly decurrent about the rachis. Corolla rotate, small, *ca.* 1.5 cm dia., pale lilac.

Type: PERU, Department Ayacucho, Province Parinacochas, Crusvuelta, 3400-3500 m alt., near Incuyo, April 1975, *C. Ochoa and A. Salas 9834* (holotype OCH, isotype CIP, OCH).

Specimens Examined

Department Arequipa

Province Caylloma: Between Viscachani and Pulpera, 3820 m alt., flowers whitish, 6 March 1981, *C. Ochoa 14267*, 2n=48 (CIP, OCH, US), and *14268*, 2n=48 (OCH).

Department Ayacucho

Province Lucanas: Highlands of Puquio, 3650-3750 m alt., 30 March 1981, *C. Ochoa 14395*, 2n=48 (OCH), *14396*, 2n=48 (CIP, OCH), *14397*, 2n=48 (OCH, from plants grown in the greenhouse at CIP-Huancayo), and *14398*, 2n=48 (CIP, OCH, US, from plants grown in the experimental field at CIP-Huancayo).

Province Parinacochas: Yanamachay, 3600 m alt., between Rebentazón and Incuyo, 15 March 1972, *C. Ochoa and A. Salas 3262* (OCH). Crusvuelta, 3400-3500 m alt., near Incuyo, April 1975, *C. Ochoa 9833*, 2n=48 (OCH), *9834*, 2n=48 (CIP, OCH, US, type collection of *Solanum acaule* f. *incuyo*), *9835*, 2n=48 (CIP, OCH, US, from plants grown in the experimental field at CIP-Huancayo in 1983).

Table 1. Fertility of *Solanum acaule* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	2	CONICIBACCATA	× *S. chomatophilum*	60(19)	47(13)	13(16)
24	2	MEGISTACROLOBA	× *S. megistacrolobum*	4(3)	3(2)	86(0)
			× *S. raphanifolium*	19	17	139
			× *S. sogarandinum*	1(7)	1(4)	20(43)
24	2	TUBEROSA	× *S. bukasovii*	61(122)	52(77)	45(32)
			× *S. bukasovii* f. *multidissectum*	2(12)	2(12)	0(11)
			× *S. goniocalyx*	8	4	150
			× *S. coelestispetalum*	4	4	13
48	4	TUBEROSA	× *S. tuberosum* subsp. *andigena*	2(2)	1(2)	10(20)
72	4	ACAULIA	× *S. albicans*	47(72)	47(62)	3(2)

FL = total number flowers pollinated, TB = total number berries obtained, SB=average number seeds per berry.

Table 2. Collections (OCH) used in *Solanum acaule* fertility studies.

ACAULIA

S. acaule 7990, 8611, 9012, 9796, 9829, 9834, 9835, 10111, 10112, 10113, 11304, 11602, 11605, 11825, 11826, 11860, 11867, 11887, 11890, 11895, 11983, 11989, 12038, 12069, 12073, 12092, 13005, 13109, 13145, 13146, 13149, 13172, 13175, 13180, 13192, 13193, 13214, 13522, 13817, 13865, 13870, 13872, 14258, 14279, 14304, 14306, 14308, 14315, 14356, 14392, 14402, 14536, 14926, 14954, 15678, 15087, 15088, 15089, 15095

S. albicans 12062, 12067, 12068, 12081A, 12084, 12089, 12090, 12091, 13014, 13019, 13239, 14789, 15155

CONICIBACCATA

S. chomatophilum 11061, 11753A, 13196, 13199, 13202, 13203, 13205, 13206, 13844

MEGISTACROLOBA

S. megistacrolobum 12032, 14272, 14273

S. raphanifolium 7610, 7619, 12040, 14296, 14318, 14346

S. sogarandinum 13336

TUBEROSA

S. bukasovii 7715, 7820, 8692, 8693, 11058, 11300, 11305, 11306, 11337, 11870, 11841, 11872, 11875, 11876, 13106, 13116, 13115, 13163, 13168, 13173, 13543, 13674, 13684, 13742, 13859, 13862

S. bukasovii f. *multidissectum* 13110, 13720

S. coelestispetalum 13632

S. goniocalyx 00001, 562-85

S. tuberosum subsp. *andigena* 15031, 15040

2. ***Solanum albicans*** (Ochoa) Ochoa, Phytologia 54(5):392, 1983.

Fig. 10-19; Map 4; Plate I.

S. acaule var. *albicans* (Ochoa), Agronomía, Lima, 27:363-364, illustr., 1960.
S. acaule subsp. *albicans* (Ochoa) Hawkes, Scott. Pl. Breed. Rec. 117, 1963.

Plants robust, rosette-like or semirosette-like, rhizomatous, light green, densely invested with brilliant white hairs 3-6 mm long, rosettes (10-)15-25(-35) cm in diameter. Stems, when present, 0.5-2.0 cm long, thick, 0.3-0.5 cm in diameter. Plant stoloniferous and tuber-bearing; stolons 20-35 cm long, frequently forming new rosettes at intervals; tubers round (Fig. 14) or elongated (Fig. 13), white, small, 1.5-2.5 cm long. Leaves imparipinnate, (5.0-)7.5-15.0(-18.5) cm long by (1.5-)3.5-5.5(-6.5) cm broad, little divided, with (2-)3-4(-5) pairs of leaflets and 0-1(-2) pairs of interjects, very rarely with 1-2 entire leaves, these, when formed, occuring only at the base of the rosette. Leaves more pilose below, especially on the rachis; the veins and veinlets of the leaflets more sparsely pilose above; hairs unequally long, white, multicellular. Terminal leaflet broadly elliptic to elliptic-lanceolate or suborbicular with an obtuse apex and broadly cuneate base, much larger than the laterals, (1.3-)3.0-6.0(-7.0) cm long by (1.2-)1.8-4.0 (-4.5) cm broad; the lateral leaflets broadly elliptic with obtuse apex and base decurrent about the rachis, the first pair above the base much more broadly decurrent than the rest, (1.0-)2.5-3.5(-4.) cm long by (0.7-)1.0-1.5(-1.7) cm broad. Pseudostipular leaves obsolescent or inconspicuous, very small, elliptic, 2-3 mm long by 1.5-1.8 mm broad. Inflorescence axillary with 3-5(-7) flowers. Peduncle obsolescent or very short, 3-4 mm, bifurcate; pedicels pigmented from 15-25 (-30) mm long, very slender and densely pilose; clearly articulated 3-5 mm below calyx. Calyx symmetric or asymmetric, light green, densely pilose, small, 5-6 mm long; lobes broadly elliptic-lanceolate, shortly acuminate or the apex nearly square, abruptly narrowed to the 1 mm-long acumen points. Corolla very light sky blue, almost white, occasionally light white-violet, rarely dark violet, rotate, 1.5-1.8 mm in diameter; the lobes extremely short with well defined acumens. Anthers broadly elliptic-lanceolate, 3.0-3.5 mm long, pale yellow, forming a strongly asymmetrical column; filaments short, 1.0 mm or less in length, white-hyalineous, glabrous. Style 6-7 mm long, glabrous, exserted, 1.5-2.0 mm long; stigma ovoid, large, 1 mm or more in length. Fruit round, uniformly light green, 1.5 cm long. Chromosome number 2n=6x=72. EBN=4.

Local Names: *Pishgo Papa* (=Bird Potato) in Cajamarca, Peru; *Aya Papa* (=Death Potato) in Cariguayrazo, Ecuador.

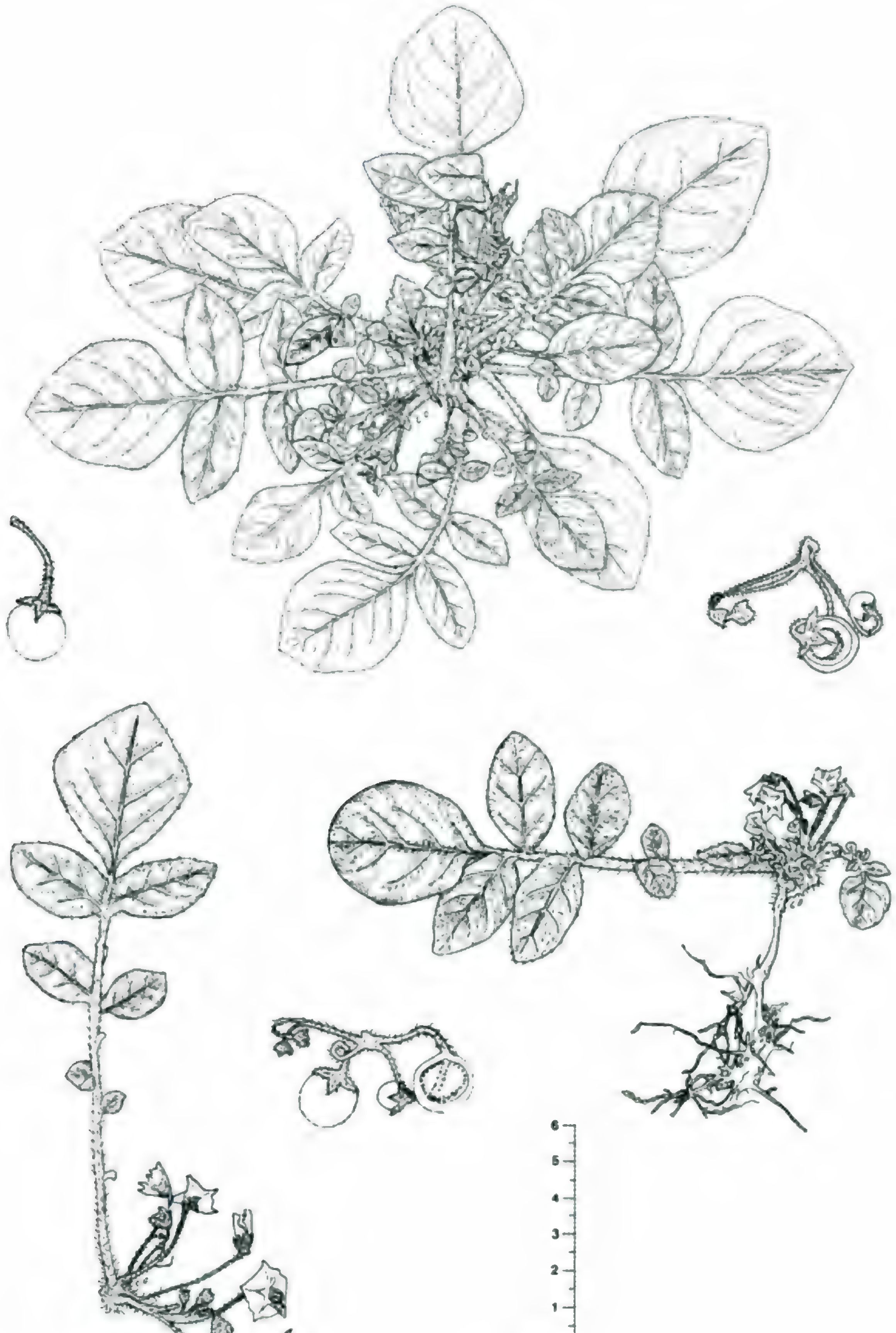


Figure 10. Drawing of *Solanum albicans* (*S. acaule* var. *albicans*, *Ochoa 2065*, holotype).

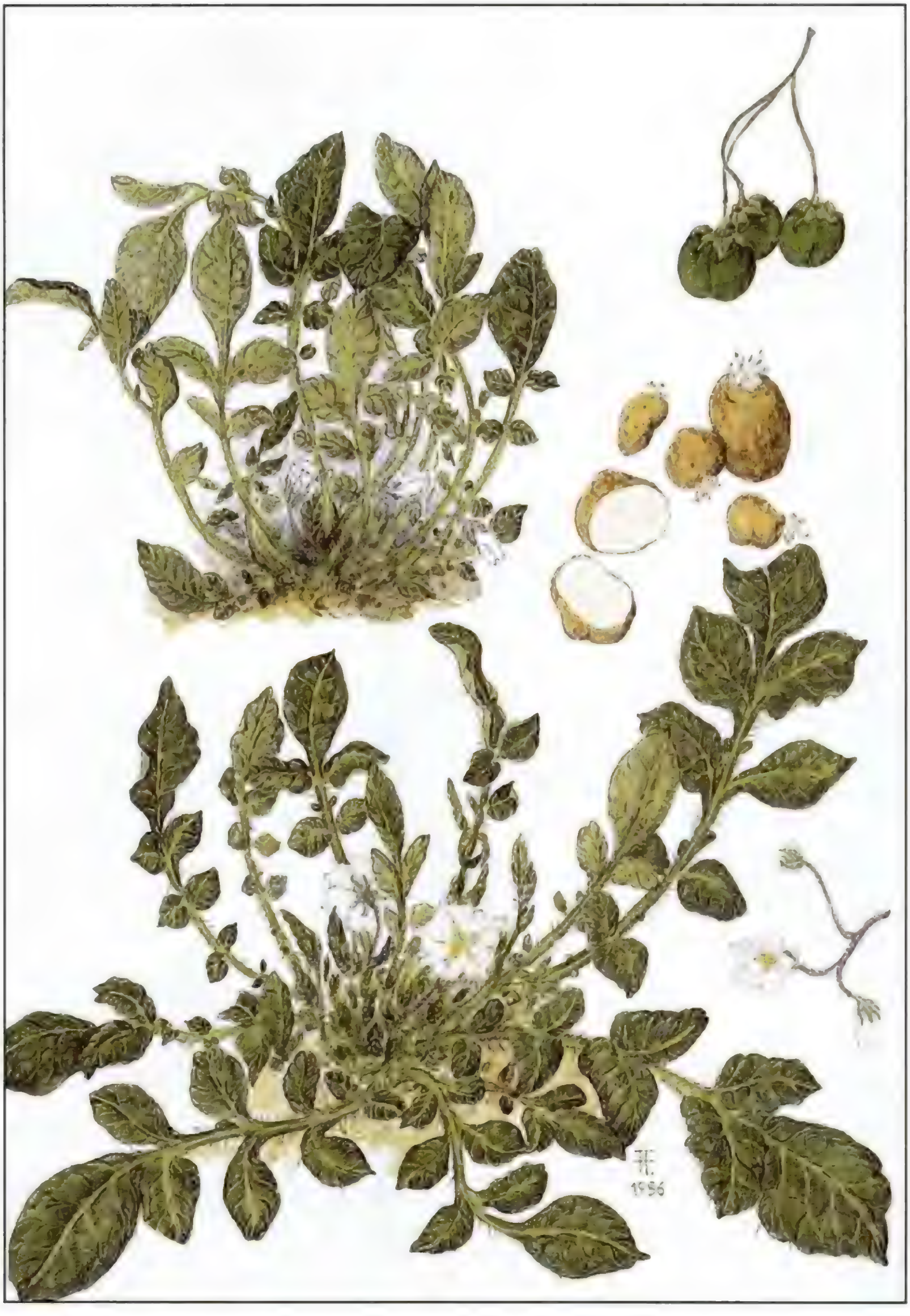


Plate I. *Solanum albicans* (Ochoa) Ochoa.

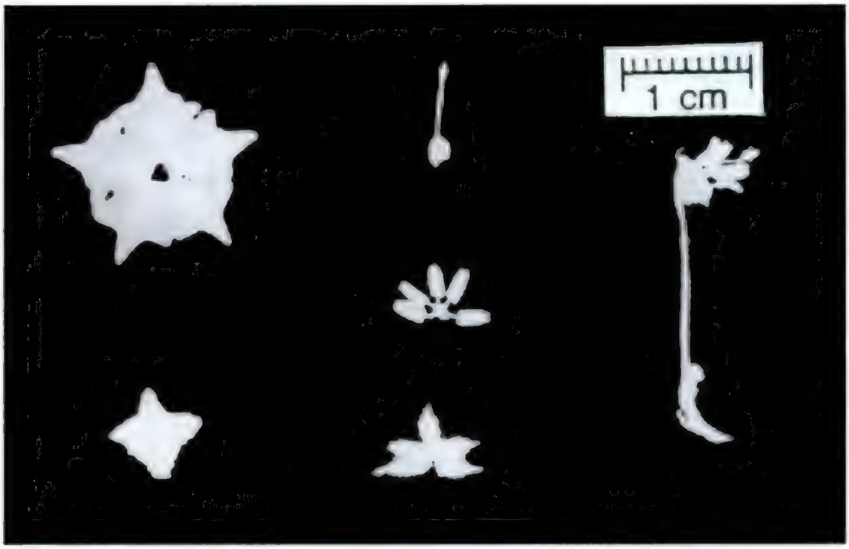


Figure 11. Floral dissection of *S. albicans*. Specimen from Tuco (4150 m alt.), Recuay, Ancash (*Ochoa 12069*).

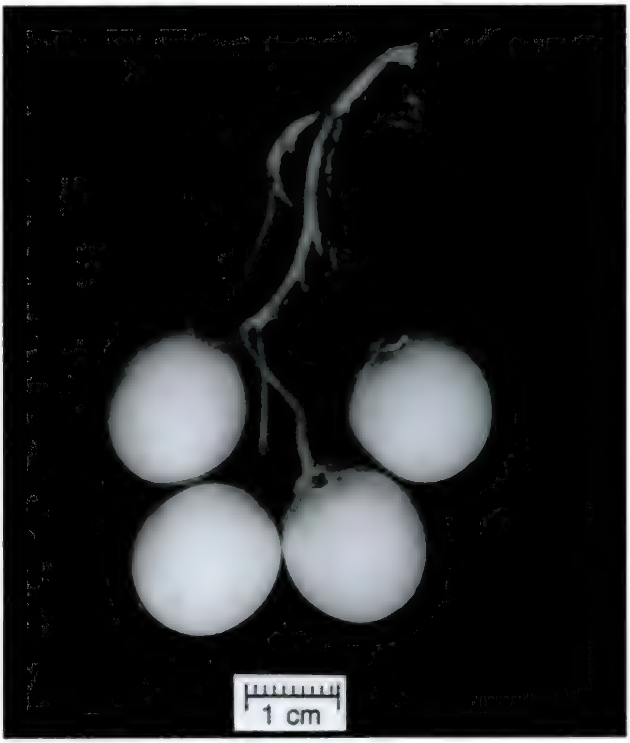


Figure 12. Berries of *S. albicans* from Chojlla (3550 m alt.), Cajamarca (*Ochoa and Salas 16023*).

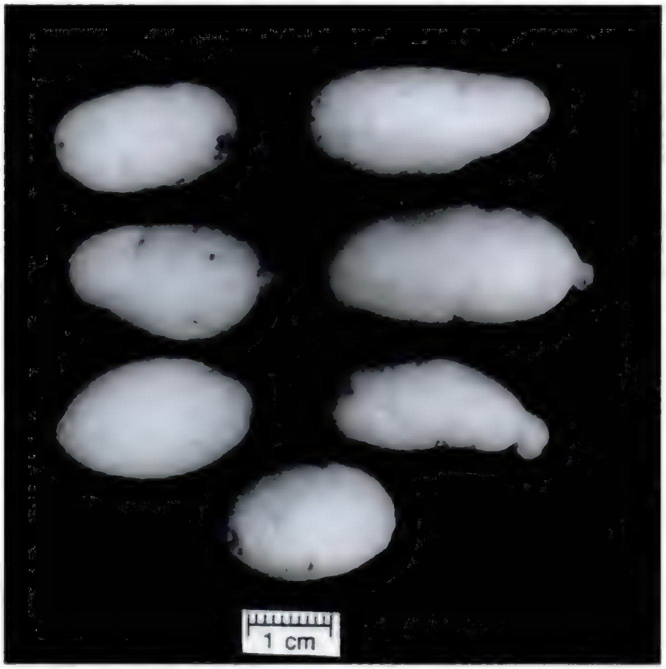


Figure 13. Tubers of *S. albicans* from Shirapata (3600 m alt.), Chavin, Ancash (*Ochoa 12083*).

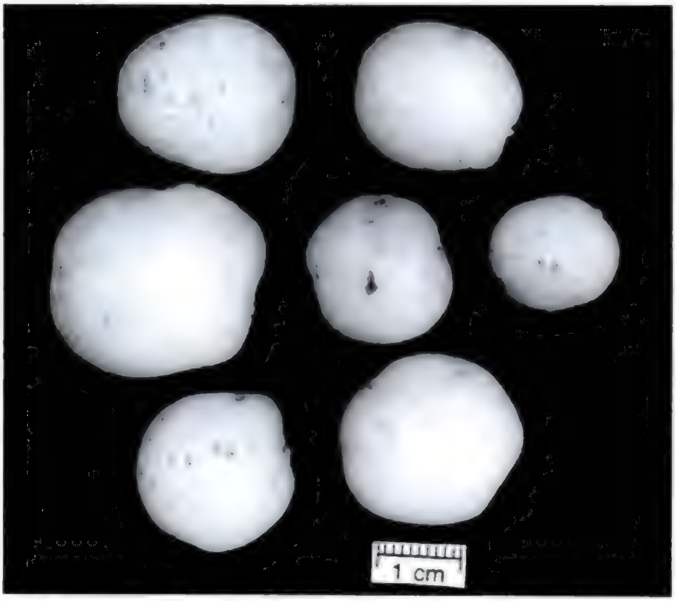


Figure 14. Tubers of *S. albicans* from Minas Llipa (3600 m alt.), Bolognesi, Ancash (*Ochoa 12063*).

Type: PERU, Department and Province of Cajamarca, Jalcas de Atocsaicu, Porcón, 3450 m, 23 May 1952, C. *Ochoa 2065*, 2n=72 (holotype OCH, isotype GH, US).

This species is clearly of hybrid origin. It appears to have originated in a natural cross between *S. acaule* and a wild diploid species, possibly *S. sogarandinum* (2n=24). The formation and fusion of two non-reduced gametes, in this case, would explain the hexaploid chromosome number of *S. albicans*.

With respect to distribution, *S. albicans* is not found south of latitude 10°35' S, while *S. acaule* does not occur north of latitude 8° S. The ranges of these two species overlap in the Provinces of Recuay, Aija, and Bolognesi in the Department of Ancash, Peru, an area which also happens to include the ranges of *S. sogarandinum* and *S. chomatophilum* (2n=24). This area of overlap also includes, in part, the range of *S. dolichocremasthrum* (2n=24), a species, however, which is presently known only from the Provinces of Recuay and Carhuaz.

With regard to the artificial crosses that have been made, F_1 populations of *S. acaule* and *S. sogarandinum* yield individuals that are extraordinarily similar to *S. albicans*, whereas the progeny of F_1 crosses between *S. acaule* and *S. chomatophilum* carry the dominant characteristics of *S. chomatophilum*.

In light of these considerations, which are based, in part, on observations of both artificial and naturally-occurring hybrid populations, it is very possible that *S. albicans* has originated in natural crosses involving *S. acaule* and *S. sogarandinum*, and quite possibly somewhere in the region between the Cordilleras Blanca and Negra of the Department of Ancash.

Affinities

Solanum *albicans* is unusual in that it is disomic and hexaploid, with 2n=6x=72 and EBN=4. Among all the known South American wild tuber-bearing species of potato, it appears to be closely related only to *S. acaule*. This species differs from the latter principally in having pedicels that are densely pilose and more clearly articulated, silvery-white pubescence, short bifurcated peduncles, and longer, glabrous and nearly always exserted styles.

Habitat and Distribution

This species is a member of the phytogeographic formation known as *jalca* in Peru, or *páramo* in Ecuador. It grows principally in open grasslands of *Stipa ichu*, *Stipa obtusa* and *Poa* sp., on gently sloping hillsides. It also occurs on rocky mountain talus slopes or in stoney quebradas with relic trees or shrubs of the

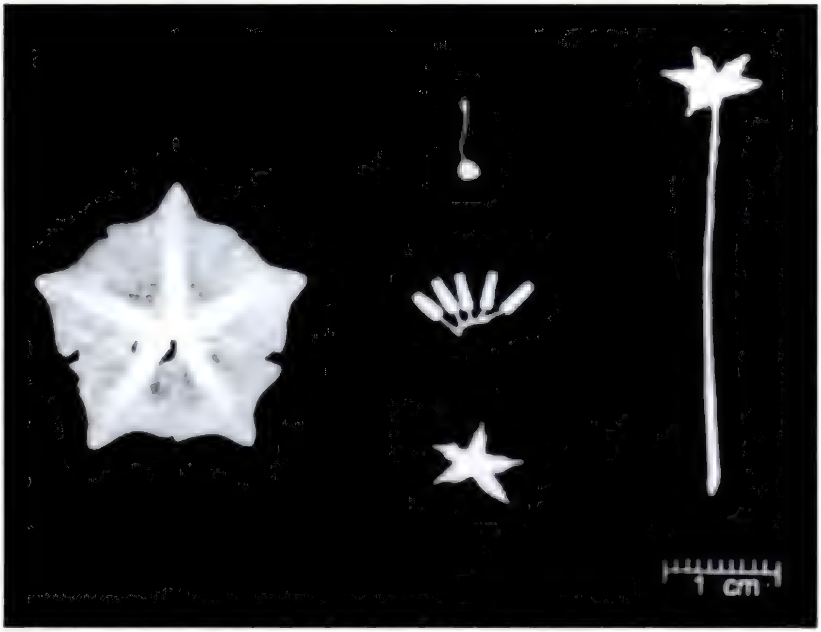


Figure 15. Floral dissection of *Solanum albicans* (*Ochoa 12062*).

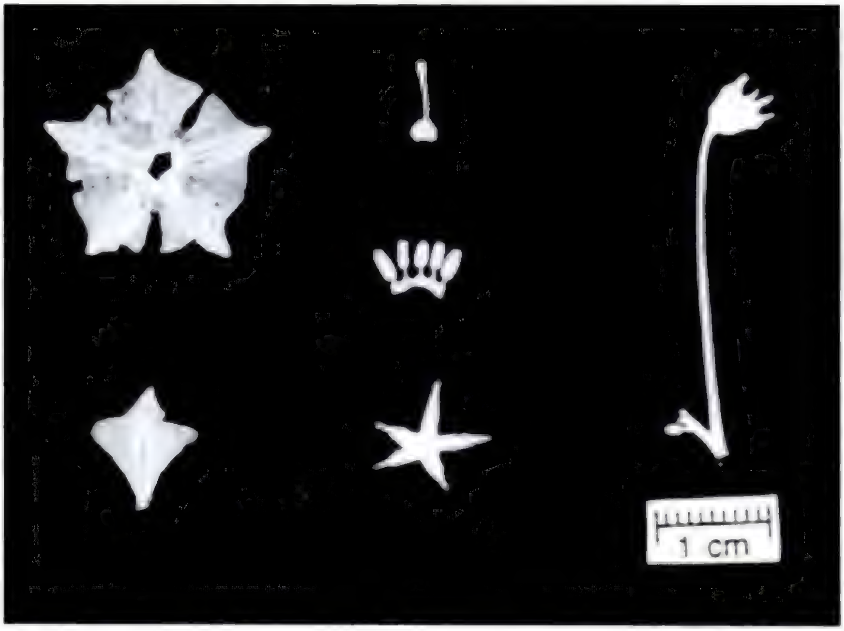


Figure 16. Floral dissection of *Solanum albicans* (*Ochoa and Salas 16023*).

genera *Buddleja*, *Polylepis*, *Gynoxis*, *Barnadesia*, *Monnina* and *Baccharis*, and with understory herbs of *Ranunculus*, *Verbena*, *Loasa* and *Oxalis*, and various species of Graminea. In the great *jalca* grasslands of Carpa, Pachacoto and Pumashimi (all localities east of Catac in the Province of Recuay, Department of Ancash), small plants of *S. albicans* often grow sheltered under the protective rigid leaves and spines of the gigantic bromeliad *Puya raimondi** or below large tufts of the semi-cushion-forming species *Ferocactus floccosus* (see Figs. 18 and 19). In this region, *S. albicans* and *S. acaule* are also found occasionally growing together side by side in precisely the same habitat. An example of this is documented by the author's field collections (Nos. *12069*, *12069-1* and *12069-2* of *S. acaule*, 2n=48, and *12069-3* of *S. albicans*, 2n=72). However, *S. albicans* rarely grows with *S. sogarandinum* in the above grasslands.

In some of the Cajamarca *jalcas*, as for example Porcón or Cumbe (Fig. 17), *S. albicans* grows near *S. chomatophilum*, and along the road from Cajamarca to Jalca de Cumbemayo, this species grows in close proximity to *S. sogarandinum*.

S. albicans is broadly distributed from the high *sierras* of Oyón and Cajatambo in the northern regions of the Department of Lima through the mountainous highlands of the Departments of Ancash, La Libertad, Huánuco and Cajamarca to Cunuyacu in the vicinity of the great volcanic cone of Chimborazo in the Province of Tungurahua, Ecuador (see Map 4), where it was found and collected for the first time in June 1979. Although the altitudinal limits of *S. albicans* lie between 3450 and 4400 m, this species is more frequently encountered at elevations ranging between 3700 and 3900 m.

Specimens Examined

Department Ancash

Province Aija: *Jalca* de Jatún Wuehuash, 3950 m alt., ascending from Wuamanwilca toward the irrigation source of Warmán, in clay, stony ground, plants rosette-like, rosettes small with leaves little divided, 2 May 1972, *C. Ochoa 3309* (OCH). Above the irrigation outlet of Warmán, 4000 m alt., ascent from Wuamanwilca to the jalcas of Sequi-Pocyan, 2 May 1972, *C. Ochoa 3315* (OCH). Huehuash, 4200 m alt., ascent from Wuamanwilca to the *punas* of Tacarpo, plants very pilose forming rosettes, tubers small, from 1-2 cm in dia., 20 June 1977, *C. Ochoa 11698*, 2n=72 (CIP, MOL, OCH, from plants grown in the greenhouse at Huancayo) and (CIP, OCH, from plants grown in the greenhouse at Huancayo). Ascent from Aija to the Hércules mines, 4000 m alt., plant rosette-like, very small, growing in black soil, scarce, 29 March 1979, *C. Ochoa 13238* (CIP, OCH). Descent from Apacheta de Aija towards Ticapampa, 3850 m alt., on the margins of the Aija-Ticapampa road, tubers only, 22 March 1979, *C. Ochoa 13239*, 2n=72 (CIP, OCH, from plants grown in the field at Huancayo) and (MOL, from plants grown in the greenhouse at Huancayo). Descent from the lagoon of Wuarmán towards Wuamanwilca, 4200 m alt., 22 April 1983, *C. Ochoa 15153*, 2n=72 (CIP, OCH). Sequipoquián, 3900 m alt., also called *toma* [outlet] of Warmán, between Wuamanwilca and the lagoon of Warmán, in poor stony soil, 22 April 1983, *C. Ochoa 15155*, 2n=72 (CIP, F, MOL, NY, OCH, US, USM), *15156*, 2n=72 (CIP, MO, MOL, OCH, USM) and (UNTC, from plants grown at CIP-La Molina, Lima), *15158*, 2n=72 (OCH) and (UNTC, from greenhouse plants grown at Huancayo).

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* This rare species of the pineapple family attains a height of 10 m or more. It is found in few places of the high Andes of Peru, including Hacienda Checayani near Azangaro, Puno; near Pucará north of Lake Titicaca; an area east-southeast of Catac along the route to the mines of Santón, Ancash; and at Huaros north-northeast of Canta, Lima.

Province Bolognesi: Lagoon at Wuamanhueque, *jalca* above Aquia, 4400 m alt., flowers bluish-purple, 2 April 1957, *R. Ferreyra 12157* (LL, two sheets). Near Llipa Mine, distr. Raján, 3600 m alt., 20-22 May 1978, *C. Ochoa and A. Salas 12062*, 2n=72 (CIP, MOL, OCH, USM), and *12063*, 2n=72 (CIP, MO, MOL, OCH, US, USM).

Province Carhuaz: Quebrada Ishinca, north side of valley, 4400 m alt., (77°25' W, 9°22' S), grassland with shrubs, *Baccharis* dominant, slopes, bouldery, granitic solid, purple flowers, 13 February 1985, *D.N. Smith, R. Valencia and A. Gonzáles 9521* (MO, US).

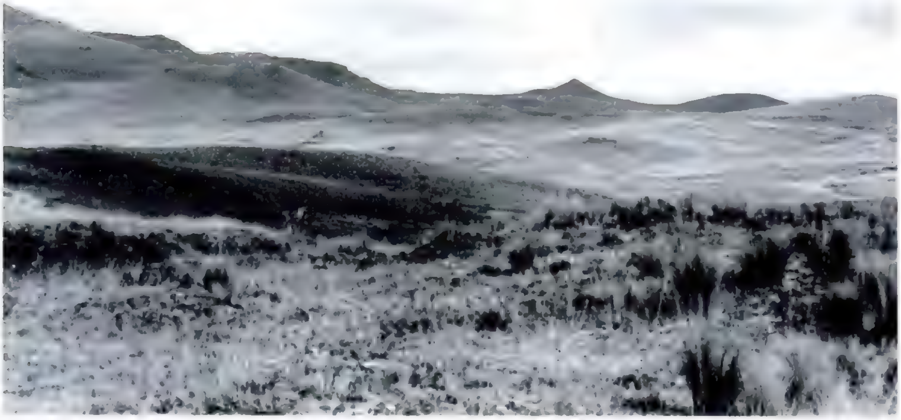


Figure 17. Habitat and type locality of *Solanum albicans*. Jalcas de Porcón (3450-3800 m alt.), north of Cajamarca.

Province Huaraz: Pampas, in *jalca* grasslands, *ca.* 4000 m alt., facing Pasto Bueno, and between large tufts of *Stipa sp.*, 15 March 1977, *C. Ochoa 11600* (CIP, OCH). Puruspunta, 3600 m alt., about 5 km from the lagoon at Llacas, ascent from Huaraz towards Wilcahuaín, in open grassland, between large tufts of *Stipa sp.*, plants densely pilose, shortly caulescent, fruits round, 19 April 1978, *C. Ochoa 12094*, 2n=72 (CIP, F, NY, OCH, US) and (USM, from plants grown in the field at Huancayo) and (MOL, UNTC, from plants of the original collection). Quebrada Shallap, 3690-4100 m alt., (77°22' W, 9°29' S), Huascarán National Park, shrubland with some severely disturbed microsites, morainal material, herb. With small tubers, flowers purple, 20 February 1985, *D.N. Smith, R. Valencia and A. Gonzáles 9666* (MO). Quebrada Rajucolta, 4000-4150 m alt.,

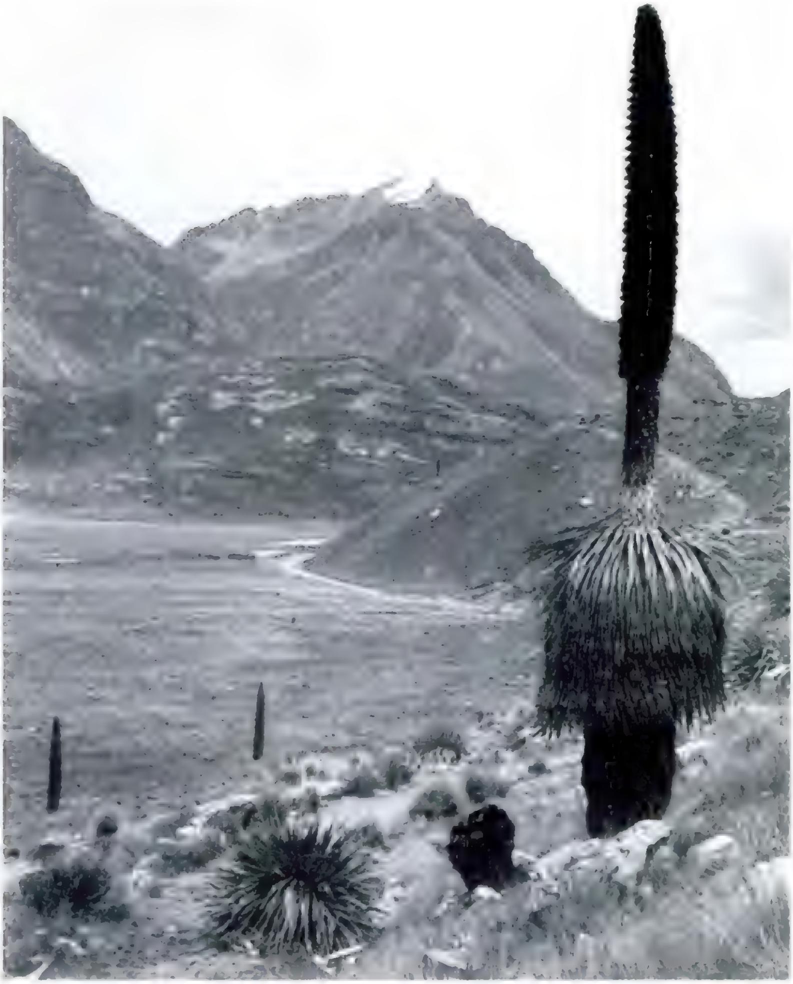


Figure 18. Habitat of *Solanum albicans* at Carpa, Ancash (4200 m alt.), here associated with *Puya raimondi* and *Stipa ichu*.

(77°22' W, 9°32' S), Huascarán National Park, in brush fields on moderate S-facing slopes, soil of granitic morainal material, bouldery, rosette, fruit green, maturing yellow, organic soils, brush, 17-18 April 1986, *D.N. Smith, M. Buddensick and R. Valencia 12179* (MO, OCH, USM).

Province Huari: Cutarengua, 4200 m alt., descent from Cawish tunnel towards Chavín, between old trees of *Buddleja* sp. and large rocks in moist soil, associated with *Stipa*, *Loasa, Ranunculus* and *Poa*, 16 April 1963, *C. Ochoa 2495* (OCH). Jalcas de Tashta, 4150 m alt., between San Luis and Huari, in grassland, 16 April 1978, *C. Ochoa 12081A*, 2n=72 (CIP, MO, MOL, NY, OCH, UNTC, USM, US). Shirapata, 3600 m alt., along the road between Cawish tunnel and Chavín, about 10 km before Chavín, 16 April 1978, *C. Ochoa 12083*, 2n=72 (CIP, F, MOL, NY, OCH, US, from plants grown at Huancayo) and (USM, from plants grown in the field at CIP-La Molina, Lima). Five km from the Carvish tunnel, 4350 m alt., (77°14' W, 9°41' S), Huascarán National Park, cliffs above *Polylepis/gynoxys* woods, moist areas, rosette, flowers violet, fruits green, 30 March 1985, *D.N. Smith 10163* (MO).

Province Huaylas: Artizonraju, entering Artezón, base of Quebrada Santa Cruz, 4300 4800 m alt., (77°36' W, 8°55' S), grassland and shrubland, rosette herb with tubers, flowers violet, 16 January 1985, *D.N. Smith, L. Sánchez and H. Vidaurre 9293* (MO, USM).

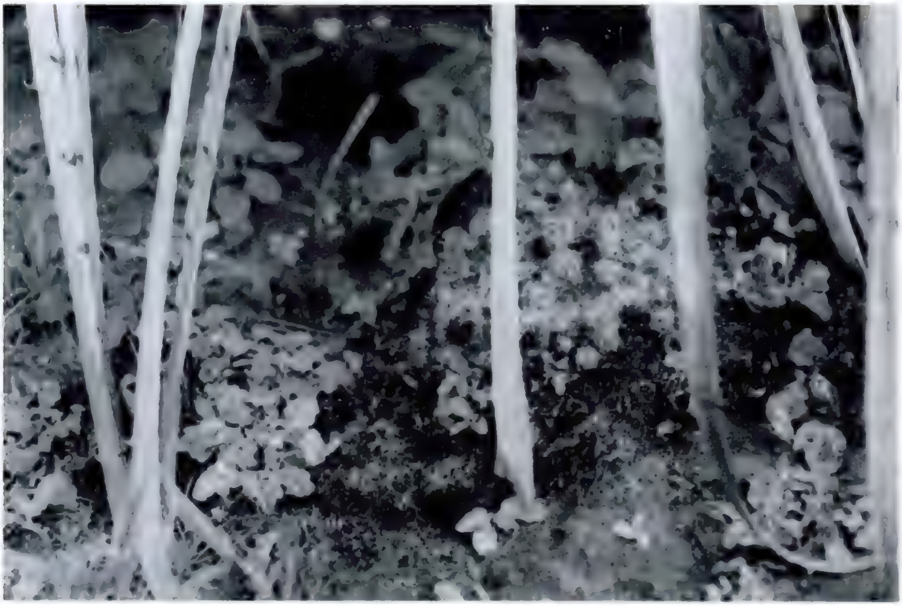


Figure 19. *Solanum albicans*, growing under the protective spiny leaves of *Puya raimondi* and alongside a *Tephrocactus* species in the *jalcas* of Carpa (4100 m alt.), Recuay, Ancash.

Province Pallasca: Jalcas above Pallasca, 3600 m alt., in grassland, 26 May 1963, *C. Ochoa 2521* (CIP, F, NY, OCH, US). Yahuarcocha, 4000 m alt., highlands of Conchucos, jalca grassland, 3 June 1963, *C. Ochoa 2536* (CIP, OCH). Pushas, 4000 m alt., near Conchucos, 5 June 1963, *C. Ochoa 2537* (OCH). Labrascocha, 3900 m alt., *jalcas* between San Miguel and Conchucos, December 1963, *C. Ochoa 2539* (CIP, OCH, UNTC).

Province Pomabamba: Chalhuacocha, 3750 m alt., jalcas along the San Miguel road to Conchucos, December 1963, C. *Ochoa 2546* (CIP, OCH).

Province Recuay: Highlands of Catac, 3700 m alt., on grassy slopes, plant rosette-like, 12 April 1959, *C. Ochoa 2165* (OCH). Recuay, 3750 m alt., about rock walls on mountain slopes, plants adpressed to the soil, without stem, 30 March 1960, *D.S. Correll and E.E. Smith P966 p.p.* (LL, plant 1= S. *albicans* and plant 2= S. *acaule*). Above Cawish tunnel, toward the east side, 4300 m alt., plants without stem, between tufts of *Ferocactus floccosus,* January 1978, C. *Ochoa 11842,* 2n=72, berries only were collected (CIP, OCH, from plants reproduced at Huancayo) and (UNTC, from plants grown in the field at CIP-La Molina, Lima). Vicinity of the Conococha lagoon, 4100 m alt., near the Chiquián road, plants stemless, between tufts of *Stipa*, 12 April 1978, *C. Ochoa 12067,* 2n=72 (CIP, MOL, OCH, US) and (UNTC, from plants grown in the field at CIP-La Molina, Lima). Near the mining seat of Tuco, 4150 m alt., some plants growing at the base or in the shade of large rocks, caulescent, plants of the open field rosette-like, 12 April 1978, *C. Ochoa 12068,* 2n=72 (CIP, MO, MOL, OCH, USM). Between Ticapampa and the Cawish Pass, before the opening of the Cawish Tunnel, on the Ticapampa-Cawish road, 4400 m alt., plants without stem forming small rosettes, 13 March *1978, C. Ochoa 12069-3* with 2n=72 growing together with *12069-1* and *12069-2,* which corresponds to S. *acaule* with 2n=48 (CIP, OCH, US). Quebrada de Pachacoto, on the Ticapampa-Carpa road, 3750 m alt., in black loose soil, scarce, plants stemless, forming rosettes 15-20 cm in dia., flowers white, tubers white, 1-3 cm long, round or elongated, 18 April 1978, *C. Ochoa 12088,* 2n=72 (CIP, MOL, OCH, US), *12089,* 2n=72, flowers lilac (CIP, OCH, UNTC, US, USM), and *12090,* 2n=72, flowers purple (CIP, MOL, OCH, USM, from plants grown in the greenhouse at Huancayo). Pumashimi, 4200 m alt., near Carpa, plants rosette-like, protected by the rigid and spiny leaves of *Puya raimondi,* in grassland, 18 April 1978, *C. Ochoa 12091,* 2n=72 (CIP, OCH, US, from plants grown in the greenhouse at Huancayo and CIP-La Molina, Lima). Carpa, 3950 m alt., in *jalca* grassland, 18 April 1978, C. *Ochoa 12093,* 2n=72 (CIP, OCH, US, from plants grown in the greenhouse at Huancayo). Between Ticapampa and Conococha, 3950 m alt., plants small, rosette-like, growing between *Stipa,* tubers small 1.0-1.5 cm, white, berries round, 10 May 1978, *C. Ochoa 13014,* 2n=72 (CIP, MO, MOL, OCH, UNTC, USM).

Ascent between Recuay and Aija, 3500 m alt., between shrubs of *Barnadesia* sp. and *Opuntia exaltata*, with conspicuous pedicel articulation, 22 March 1979, *C. Ochoa 13241* (OCH). Rio Pachacoto drainage between mineral springs and Pumashimi, 4230 m alt., (77°17' W, 9°53' S), *Stipa obtusa* tussock grassland in relatively dense stand of *Puya raimondi*, herb, rosette, tubers, flowers violet, disturbed spot with organic soils, 16 March 1986, *D.N. Smith and M. Torres 11812* (MO, OCH, USM).

Province Sihuas: Laguna Grande at Santa Cruz, 4200 m alt., in a corral with abundant dung and between the crevices of a rock wall, 12-16 May 1978, *C. Ochoa 13019*, 2n=72 (CIP, MOL, NY, OCH, UNTC, USM, US, from plants grown in the greenhouse at La Molina, Lima).

Province Yungay: Quebrada Chacraraju, field at base, 4400 m alt., (77°36' W, 9°01' S), 12 April 1985, *D.N. Smith and V. Cautivo 10255* (MO, OCH, USM). Huishca, 4250 m alt., between Llanganuco and Yanama, plants very pilose, growing near S. *chomatophilum*, 17 April 1978, *C. Ochoa 12084A*, 2n=72 (OCH, from plants reproduced at CIP-La Molina, Lima).

Department Cajamarca

Province Cajamarca: Between jalca grasses at Atokk Saicku, 3450 m alt., along the road between Cajamarca and Hacienda Porcón, growing on poor gravely soil or in sandy-clay, plants small rosette-like with fruits varying from round to ovoid, light green, 23 May 1952, *C. Ochoa 2065*, 2n=72 (GH, OCH, US, type collection of *Solanum acaule* var. *albicans*, here designated as the holotype of *S. albicans*), also (CIP, from plants grown in the greenhouse at Huancayo, and LL, from plants grown in the field at Sturgeon Bay, Wis., USA, IR-1 Project). Hacienda Porcón, 3500 m alt., north of Cajamarca, 6 km from entrance, open grassy slope, flowers light lavender, 25 March 1960, *D.S. Correll and E.E. Smith P863* (LL, US). Jalcas de La Chokklla, *ca.* 3700 m alt., along the Cajamarca-Hualgayoc road in loose soil, very moist, 20 May 1982, *C. Ochoa 14789*, 2n=72 (OCH) and (CIP, F, MOL, NY, OCH, UNTC, from plants grown in the greenhouse at Huancayo). Jalcas de Chokklla, 3550 m alt., along the Cajamarca-Hualgayoc road, 1 April 1992, *C. Ochoa and A. Salas 16022 and 16023* (CIP, OCH), *16024* (CIP, MOL, OCH, UNTC), *16025*, 2n=72, only berries were collected (CIP, OCH, from plants grown from seed at La Molina, Lima, and MOL, OCH, from plants grown from seed in the greenhouse at Huancayo), *16026*, 2n=72, only berries were collected (OCH, from plants grown from seed at La Molina, Lima), and *16027*, 2n=72 (OCH) and (CIP, OCH, from plants grown from seed at La Molina, Lima) and (MOL, OCH, UNTC, from plants grown from seed in the greenhouse at Huancayo). Near the Yana Totora River, 3560 m alt., south of the lagoons, 1 April 1992, *C. Ochoa and A. Salas 16028* (CIP, OCH), *16029*, 2n=72

(CIP, OCH), *16031*, berries only (CIP, MOL, OCH, UNTC, from plants grown from seed at Huancayo, and OCH, from plants grown from seed at La Molina, Lima), *16032* (CIP, MOL, OCH, UNTC, from plants grown from seed in the greenhouse at Huancayo, and OCH, from plants grown from seed at La Molina, Lima), *16033*, 2n=72 (CIP, OCH, from plants grown from seed in the greenhouse at Huancayo), *16034* (CIP, USM, from plants grown from seed at La Molina, Lima, and OCH, from plants grown in the greenhouse at Huancayo) and *16036*, 2n=72 (CIP, OCH, from plants grown from seed at Huancayo, and USM, from plants grown from seed at La Molina, Lima). Jalcas de Perlamayo, 3500 m alt., between theYana Totora River and Las Lagunas, 1 April 1992, *C. Ochoa and A. Salas 16037*, 2n=72 (CIP, MOL, from plants grown in the greenhouse at Huancayo) and (OCH, original plant) and (OCH, UNTC, USM, from plants grown from seed at La Molina, Lima), *16038* (CIP, from plants grown at La Molina, Lima) and (OCH, USM, from plants grown in the greenhouse at Huancayo) and *16039*, 2n=72 (CIP, MOL, from plants grown from seed at La Molina, Lima) and (OCH, UNTC, from plants reproduced at Huancayo). Jalcas de Huacarumi, 3680 m alt., 4-5 km east of Tantahual, 1 April 1992, *C. Ochoa and A. Salas 16043*, 2n=72 (CIP, OCH, from plants originally collected *in situ*) and *16043* (CIP, OCH, from plants grown from seed in the greenhouse at Huancayo). Río Las Lagunas, 3700 m alt., north of Chokklla, 2 April 1992, *C. Ochoa and A. Salas 16047*, 2n=72 (CIP, OCH, from plants grown at La Molina, Lima), *16048* (CIP, OCH, USM, from plants reproduced at La Molina, Lima) and (MOL, OCH, UNTC, from plants grown in the greenhouse at Huancayo), *16049* (CIP, OCH, from plants grown at La Molina, Lima) and (CIP, MOL, OCH, from plants grown at Huancayo) and *16050*, 2n=72 (CIP, OCH, UNTC, from plants grown at La Molina, Lima) and (MOL, OCH, from plants reproduced at Huancayo). Jalcas de Sedano, 3620 m alt., between La Manzana and Coramayo, 2 April 1992, *C. Ochoa and A. Salas 16052*, 2n=72 (CIP, OCH) and (CIP, OCH, from plants grown at Huancayo and La Molina, Lima), *16053*, 2n=72 (CIP, OCH) and (CIP, OCH, from plants reproduced at Huancayo) and (OCH, USM, from plants grown at La Molina, Lima) and *16054*, 2n=72 (CIP, OCH, USM, from plants grown at Huancayo and La Molina, Lima). Quinual, 3650 m alt., facing the Sedano *jalcas*, between patches of *Polylepis* sp. and tufts of *Stipa* sp., 2 April 1992, *C. Ochoa and A. Salas 16055*, 2n=72 (CIP, OCH, UNTC, from plants grown in the greenhouse at Huancayo) and (CIP, USM, from plants grown at La Molina, Lima), *16056*, 2n=72 (CIP, OCH, from plants reproduced at La Molina, Lima) and (OCH, USM, from plants grown at Huancayo), and *16057 and 16058* (CIP, OCH, from plants grown at La Molina, Lima) and (OCH, USM, from plants grown at Huancayo).

Department Huánuco

Province Dos de Mayo: Slopes of Cerro Ullucumachay, 3900 m alt., about 5 km from Huambalia, near Quivilla, plants vigorous, rosette-like, in grassland, 21 April 1967, C. *Ochoa 2630* (=*Och S41*) (OCH).

Province Huamalíes: Jalcas de Cachu Cruz, 3850 m alt., highlands of Tantamayo, along the road to Monzón, mature berries were collected, April 1967, C. *Ochoa S-79,* 2n=72 (OCH). Chasqui, 3650 m alt., distr. Jacas Grande, May 1972, C. *Ochoa 3647,* 2n=72 (OCH, from plants reproduced from tubers in 1973 at the Universidad Nacional Agraria La Molina, Lima). Jalcas de Cachu Cruz, 3700 m alt., highlands of Tantamayo, between large rocks, May 1972, C. *Ochoa 3651* (OCH).

Department La Libertad

Province Santiago de Chuco: Cerro Ichal, 3500 m alt., facing the jalcas of the Hacienda San José, 1 April 1970, C. *Ochoa 2713*, 2n=72 (OCH, from plants grown from seed at the Universidad Nacional Agraria La Molina, Lima, in November 1971).

Department Lima

Province Cajatambo: Jalcas de Pomaca, between Cajatambo and Oyón, 3900 m alt., plants rosette-like, flowers pale lilac, pedicel articulation visible, collected mature berries, April 1960, C. *Ochoa S-21*, 2n=72 (=*PI-365306*) (OCH).

Breeding Potential

The results of crosses of *S. albicans* with various diploid (2=24, EBN=1 or 2), tetraploid (2n=48, EBN=2) and hexaploid (2n=72, EBN=4) species are given in Table 2. Incompatible crosses and their reciprocals are indicated, respectively, by a single (*) or double (**) asterisk. Collections numbers are given in Table 3.

Reciprocal crosses of *S. albicans* with *S. ancophilum*, *S. bukasovii* and *S. chomatophilum* were on the whole very successful, and most berries produced a normal amount of seeds. However, fairly low seed set resulted when *S. albicans* was crossed with either *S. sogarandinum*, *S. raphanifolium* or *S. megistacrolobum*. Similarly, the crosses made with *S. lignicaule* and *S. wittmackii* (EBN=1) yielded viable seeds, but few in number. However, the unilateral cross of *S. albicans* (EBN=4) with the normally self-incompatible, cultivated diploid species, *S. phureja* (EBN=2), turned out to be of special interest. Not only did this cross yield a great number of seeds unexpectedly, but the plants produced from them were later found to be self-compatible.

Also, other somewhat surprising results were obtained. Crosses of *S. albicans* with *S. acaule*, for example, produced a large number of parthenocarpic berries (these having developed without the benefit of cross pollination). The few normally-developed berries that were obtained in this cross were later found to contain but 2-3 seeds each on the average.

And lastly, F_1 populations of S. *albicans* × *S. ancophilum* yielded tetraploid plants that were exceedingly similar with respect to plant habit and the shape and dissection of their leaves. Moreover, these hybrids were notable in producing masses of showy flowers. The unilateral crosses of *S. albicans* with *S. × arahuayum* resulted in incompatibilty. The EBN of the last species is unknown.

Table 3. Fertility of *Solanum albicans* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	LIGNICAULIA	× *S. lignicaule*	4	1	2
		TUBEROSA	× *S. immite*	1	1	8
			× *S. wittmackii*	2	2	15
24	2	CONICIBACCATA	× *S. chomatophilum*	88(90)	47(67)	6(3)
			× *S. urubambae*	6	6	0
24	2	MEGISTACROLOBA	× *S. megistacrolobum*	6(5)	3(5)	0(7)
			× *S. raphanifolium*	13(7)	(10)6	(2)2
			× *S. sogarandinum*	37	36	10
24	2	PIURANA	× *S. chiquidenum*	4	1	0
			× *S. paucissectum*	11	5	0
24	2	TUBEROSA	× *S. amayanum**	4	4	0
			× *S. ancophilum*	17(18)	2(1)	26(0)
			× *S. bukasovii*	50(91)	49(62)	(15)2
			× *S. bukasovii* f. *multidissectum*	13(84)	10(82)	12(1)
			× *S. leptophyes*	2	2	0
			× *S. marinasense*	5	1	0
			× *S. phureja*	3	3	108
24	3	TUBEROSA	× *S. arahuayum*	6	6	0
48	2	ACAULIA	× *S. acaule*	67(53)	58(53)	2(3)
			× *S. acaule* f. *incuyo*	3(3)	3(3)	0(0)
72	4	CONICIBACCATA	× *S. nemorosum*	9(7)	0(0)	0(0)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 4. Collections (OCH) used in *Solanum albicans* fertility studies.

ACAULIA
S. acaule 10112, 11989, 12038, 12069, 12073, 13005, 13145, 13146, 13175, 13180, 13193, 13214, 13522, 13817, 13865, 13872, 14258, 14279, 14304, 14306, 14315, 14356, 14392, 14926, 14952, 14954, 15087, 15088, 15089, 15095
S. acuale f. *incuyo* 14397, 14398
S. albicans 11842, 12062, 12063, 12067, 12068, 12081A, 12088, 12089, 12090, 12091, 12094, 13014, 13019, 13238, 13239, 13395, 14789, 15155

CONICIBACCATA
S. chomatophilum 11061, 13196, 13198, 13199, 13200, 13202, 13205, 13325, 13332, 13341, 14485, 14786, 14788, 14824
S. nemorosum 14809
S. urubambae 13779

LIGNICAULIA
S. lignicaule 11316

MEGISTACROLOBA
S. megistacrolobum 14172, 14273
S. raphanifolium 13564, 13695, 13759
S. sogarandinum 13006, 13336

PIURANA
S. chiquidenum 11059
S. paucissectum 14817

TUBEROSA
S. amayanum 4299
S. ancophilum 12086A
S. arahuayum 13257
S. bukasovii 7726, 8692, 8693, 9803, 11058, 11300, 11301, 11841, 11844, 11866, 11872, 11876, 13113, 13116, 13123, 13275, 14333
S. bukasovii f. *multidissectum* 11843, 13720
S. immite 14491
S. leptophyes 13671
S. marinasense 14303
S. phureja 15132
S. wittmackii 10982

SERIES CONICIBACCATA

CONICIBACCATA Bitt., Fedde Repert., 11:381, 1912.

Oxycarpa Rydb., Bull. Torrey Bot. Club 51:146, 172, 1924, *nom. nud.*

Chomatophila Gorbat., Bull. Bot. Appl. Genet. Pl. Breed., Leningrad 126:95, 1989.

Plants herbaceous, tuberous, from essentially glabrous to densely pilose and from small or medium, 0.40-0.50 m tall, to large and very large, 1.5-2.5 m or more tall. Leaves imparipinnate from little divided to very divided, with or without interjected leaflets; pedicels variously articulated from above the base to slightly above center. Corolla rotate, rotate-pentagonal or substellate to stellate, purple in the majority of the species, less frequently blue or white. Fruit ovoid to ovate-conical or long-conical with obtuse or pointed apex. Chromosome number: 2n=24, 2n=48 and 2n=72. EBN=2 and EBN=4.

Bitter (1912), in proposing the series Conicibaccata, failed to designate a type specimen. However, D'Arcy (1972) proposed the Mexican species *S. oxycarpum* (named by Schiede in 1841) as the lectotype of Rydberg's series Oxycarpa. Unfortunately, this series name is in itself a *nomen nudem*.

Little morphological and cytogenetical data is available for the plants of this series. Thus, up to the present time, it has not been possible to establish the relationship of this series with others of this section, or, for that matter, to determine its nearest affinities.

With regard to breeding, it would appear that at least some of the various species of series Conicibaccata are of great potential value in potato improvement programs. Resistance to the late blight organism, *Phytophthora infestans*, is found in *S. chomatophilum*; whereas, strains resistant to early blight (caused by *Alternaria solani*) and wilt (caused by *Verticillium* sp.) are found in *S. chomatophilum*, *S. laxissimum*, *S. santolallae* and *S. limbaniense*. Other diseases and their corresponding resistant species in series Conicibaccata are as follows: Ring rot (*Corynebacterium sepedonicum*) in *S. chomatophilum* and *S. limbaniense*; blackleg (*Erwinia carotovora*) in *S. chomatophilum*; and, viruses PLRV, PMV, and PVX in *S. chomatophilum*, PLRV in *S. limbaniense*, and TRV in *S. laxissimum*.

Series Conicibaccata also contains forms that are resistant to certain types of insect damage, including that caused by the Colorado Potato Beetle (*Leptinotarsa decemlineata*), flea beetle (*Empoasca* sp.) and leafbug (*Lygus* sp.). Resistance to the root knot nematode (*Meloidogyne* sp.) is also found in *S. chomatophilum*. Moreover, two species, *S. santolallae* and *S. urubambae*, appear to be highly tolerant of high heat and excessive moisture; whereas, three others, *S. chomatophilum*, *S. nubicola* and *S. irosinum*, are apparently resistant to frost, or to abrupt drops in ambient temperature.

Habitat and Distribution

The greater part of the species of series Conicibaccata live preferentially in regions having moist valleys and a benign climate, such as in the low mountains and moist forests of the *Ceja de Montaña*. However, a few Peruvian species, such as *S. limbaniense* and *S. chomatophilum*, thrive in high, cold *puna* or *jalca* regions at altitudes ranging from 3600-4000 m.

With a grand total of 37 species, series Conicibaccata is exceeded in size only by series Tuberosa, and, like that series, is distributed over a large part of the Americas.

Starting with the southernmost limits of this series in South America, its members range as follows: Bolivia, three species (*S. violaceimarmoratum*, *S. bombycinum* and *S. neovavilovii*, all 2n=24); Peru, the major center of diversity of this series, has 17 species, all endemic (see treatment in present work); Ecuador, four species (*S. colombianum*, 2n=48 and native also to Colombia and Venezuela, *S. paucijugum*, 2n=48, *S. tundalomense*, 2n=72, and *S. albornozii*, 2n=24); Colombia, with 10 species has the second largest center of diversity (*S. colombianum*, *S. cacetanum*, *S. cuatrecasaii*, *S. donachui*, *S. flahaultii*, 2n=48 and native also to Venezuela and Panama, *S. moscopanum*, 2n=72, *S. orocense*, *S. otites*, which also ranges into Venezuela, *S. pamplonense*, 2n=48, and *S. sucubunense*); and Venezuela, which has a single endemic species (*S. subpanduratum*, 2n=48), and three that find their way to Panama (*S. otites*, *S. flahaultii* and *S. woodsonii*). In addition to the above species, the following four

Colombian species are probably best relegated to synonomy: *S. dolichocarpum*; *S. filamentum* and *S. venezuelicum* (both equal to *S. colombianum*); and, *S. neovalenzuelae* (=*S. flahaultii*).

Only three species of this series, all tetraploid (2n=48), are found north of Panama: *Solanum longiconicum* occurs in Costa Rica, Guatemala and Mexico; *S. agrimonifolium* in Honduras, Guatemala and Mexico; and, *S. oxycarpum*, endemic to Mexico.

KEY TO SERIES CONICIBACCATA

1. Terminal leaflet much larger than the laterals.
  2. Leaflets ovate.
    3. Leaves simple or with 1-2 pairs of lateral leaflets .... 19a. *S. urubambae* f. *chakchabambense*
    3. Leaves with 3-4 pairs of lateral leaflets .... 7a. *S. chomatophilum* var.*subnivale*
  2. Leaflets lanceolate.
    4. Stems narrowly winged. .... 7b. *S. chomatophilum* f. *sausianense*
    4. Stems not winged .... 19b. *S. urubambae* f. *velutinum*
1. Terminal leaflet slightly larger or equal to the laterals.
  5. Terminal leaflet slightly larger than the laterals.
    6. Terminal leaflets rhombic-lanceolate .... 16. *S. rhombilanceolatum*
    6. Terminal leaflet ovate-lanceolate to orbicular .... 19. *S. urubambae*
  5. Terminal leaflet about equal in size to the laterals.
    7. Inflorescence cymose-paniculate.
      8. Terminal leaflet elliptic-lanceolate.
        9. Style short, less than 7 mm long. .... 8a. *S. irosinum* f. *tarrosum*
        9. Style large, 10-12 mm long .... 9. *S. jaenense*
      8. Terminal leaflet ovate to rhombic.
        10. Terminal leaflet ovate....18. *S. santolallae*
        10. Terminal leaflet rhombic .... 11. *S. limbaniense*
    7. Inflorescence paniculate.
      11. Terminal leaflets lanceolate.
        12. Fruit ovoid-conical.... 8. *S. irosinum*
        12. Fruit ovoid............ 13. *S. neovargasii*

11. Terminal leaflets elliptic to elliptic-lanceolate.
13. Terminal leaflet elliptic .... 3. *S. ayacuchense*
13. Terminal leaflet broadly elliptic to elliptic-lanceolate.
14. Terminal leaflet broadly elliptic .... 15. *S. pillahuatense*
14. Terminal leaflet elliptic-lanceolate.
15. Lateral leaflets of 5-6 pairs.
16. Style 10-12 mm long ....14. *S. nubicola*
16. Style very large, greater than 12 mm long.
17. Lateral leaflets sessile .... 7. *S. chomatophilum*
17. Lateral leaflets petiolulate.
18. Petiolules 1-2 mm long .... 17. *S. salasianum*
18. Petiolules 3-5 mm long .... 4. *S. buesii*
15. Lateral leaflets consisting of more than 6 pairs.
19. Style 10-12 mm long.
20. Lateral leaflets subsessile, 1-2 mm long.
21. Floral pedicels 20-30 mm long .... 5. *S. burkartii*
21. Floral pedicels greater than 30 mm long .... 12. *S. nemorosum*
20. Lateral leaflets on petiolules 3-5 mm long .... 10. *S. laxissimum*
19. Style greater than 12 mm long .... 6. *S. contumazaense*

3. *Solanum ayacuchense* Ochoa, Agronomia, Lima, 26:312, 313, 314, illustr., 1959. Fig. 20-21; Map 5.

Plant erect or erect-decumbent, (30-)50-7.0 cm tall. Stem branched, thick, to 10 mm in diameter at base, lightly pigmented, broadly winged, wings sinuous; internodes (1.5-)2.5-5.5 cm long; stolons 50-70 cm long; tubers large, white, with numerous lenticels, generally long-cylindrical or subcylindrical, 10-12 cm long by 3.0-3.5 cm in diameter, rarely ovoid. Leaves subglabrous or sparsely and shortly pilose on both sides, imparipinnate, (10.5) 13.5-18.5(-22.0) cm long, including the petiole, by (7-)9-11(-14) cm wide, with 3-4 pairs of lateral leaflets, long petiolulate; petiolules (3-)6-7 mm to15 mm long, with 0-2(-3) pairs of subsessile interjected leaflets; petioles 2.5-4.0 cm long. Leaflets ovate-elliptic to elliptic or elliptic-lanceolate, broadly rounded or somewhat truncated at the slightly oblique base, apex shortly acuminate or pointed; terminal leaflet slightly larger than the adjacent lateral leaflets, (3.5-)4.5-6.0(-10.0) cm long by (2.0-)2.5-3.0(-4.0) cm wide; the first upper pair of leaflets (3.0-)3.5-5.5(-8.5) cm long by (1.5-)2.0-3.0(-3.0) cm wide. Pseudostipular leaves obsolescent or very small, 5 mm long. Inflorescence cymose-paniculate, lateral or subterminal, with 10-14 flowers. Peduncle short 4.5-6.5 cm long by 2.0-2.5 mm in diameter, forked, lightly pigmented; pedicels short 15-20 mm long, pigmented; articulated at the midpoint or slightly below center. Calyx symmetrical, small, 5-7 mm long, pig-

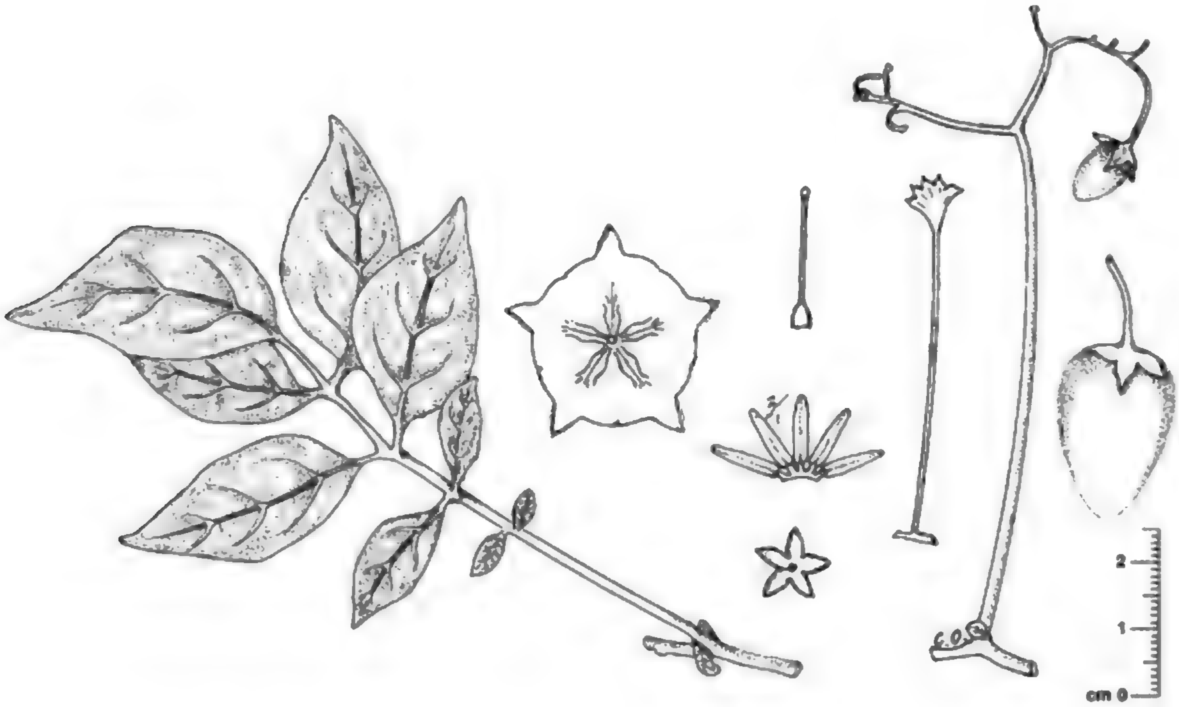


Figure 20. Drawings of the leaf, berries and floral parts of *Solanum ayacuchense* (*Ochoa 2150*, type).

mented, glabrous; the lobes ovate-lanceolate, the apex apiculate. Corolla rotate 2.0-2.5 cm in diameter, pale violet with the internal star white-hyaline or grayish white; the lobes short, less than 1.5 mm long, acumens 2.5 mm long, sparsely pilose on the outside. Anthers lanceolate 5 mm long, pale yellow, distinctly cordate at base; filaments less than 1 mm long, shortly pubescent. Style 7-8 mm long, exerted 1.5-2.0 mm, very slender or filiform, papillose on the lower one-third of its length; stigma capitate. Fruit long-conical, light green, 2.0-2.5 cm long.

Chromosome number 2n=24.

Type: PERU. Department Ayacucho, Province La Mar, Yanta Yanta, 3000 m alt., 11 February 1958, C. *Ochoa 2150* (holotype OCH).

Affinities

Although related to S. *laxissimum*, *Solanum ayacuchense* differs from that species principally by the shape and color of its corolla, the pubescence of its filaments, the poorly dissected leaves, and the more broadly elliptic-lanceolate to ovate-lanceolate leaflets.

Habitat and Distribution

Solanum ayacuchense thrives in very moist thickets of herbs and shrubs, from 2800 to 3000 m alt., and is very rare. Its distribution is restricted to its type locality of Yanta Yanta in the northeast sector of the Department of Ayacucho in central Peru. Presently, this zone is very deprecated, with its natural vegetation almost wholly destroyed by man (Map 5).

Specimens Examined

Department Ayacucho

Province La Mar: Yanta Yanta, *ca*. 3000 m alt., among a thicket of shrubs and herbs, 11 February 1958, C. *Ochoa 2150* (OCH, type collection of S. *ayacuchense*). District Tambo, between Tambo and Yanamonte, 3200 m alt., 23 April 1972, C. *Ochoa 3299* (OCH, sterile). Between Tambo and San Miguel, 3000-3100 m alt., 10 February 1975, C. *Ochoa 7282* and *7283* (OCH). Between Ayna and Ccano, 2000 m alt., 10 February 1975, C. *Ochoa 7331* (OCH, sterile).

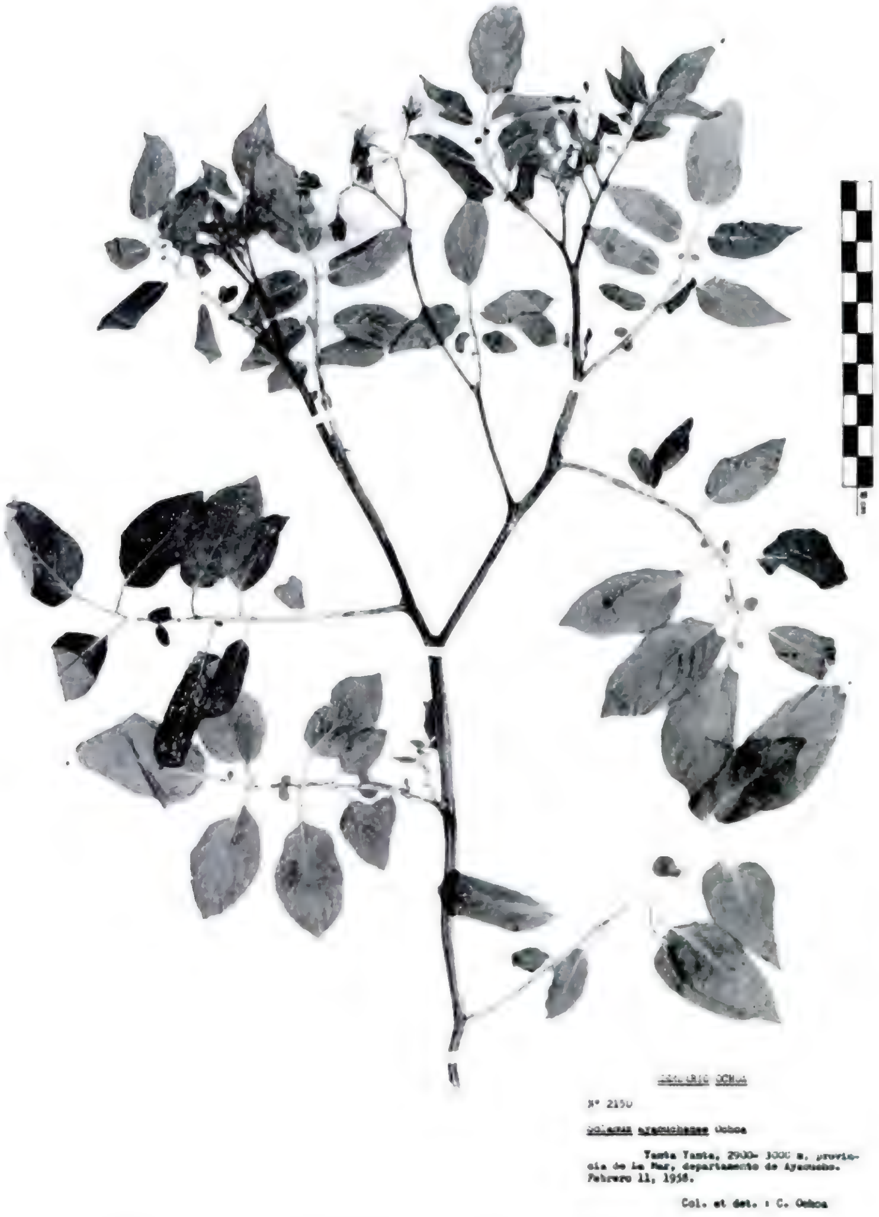
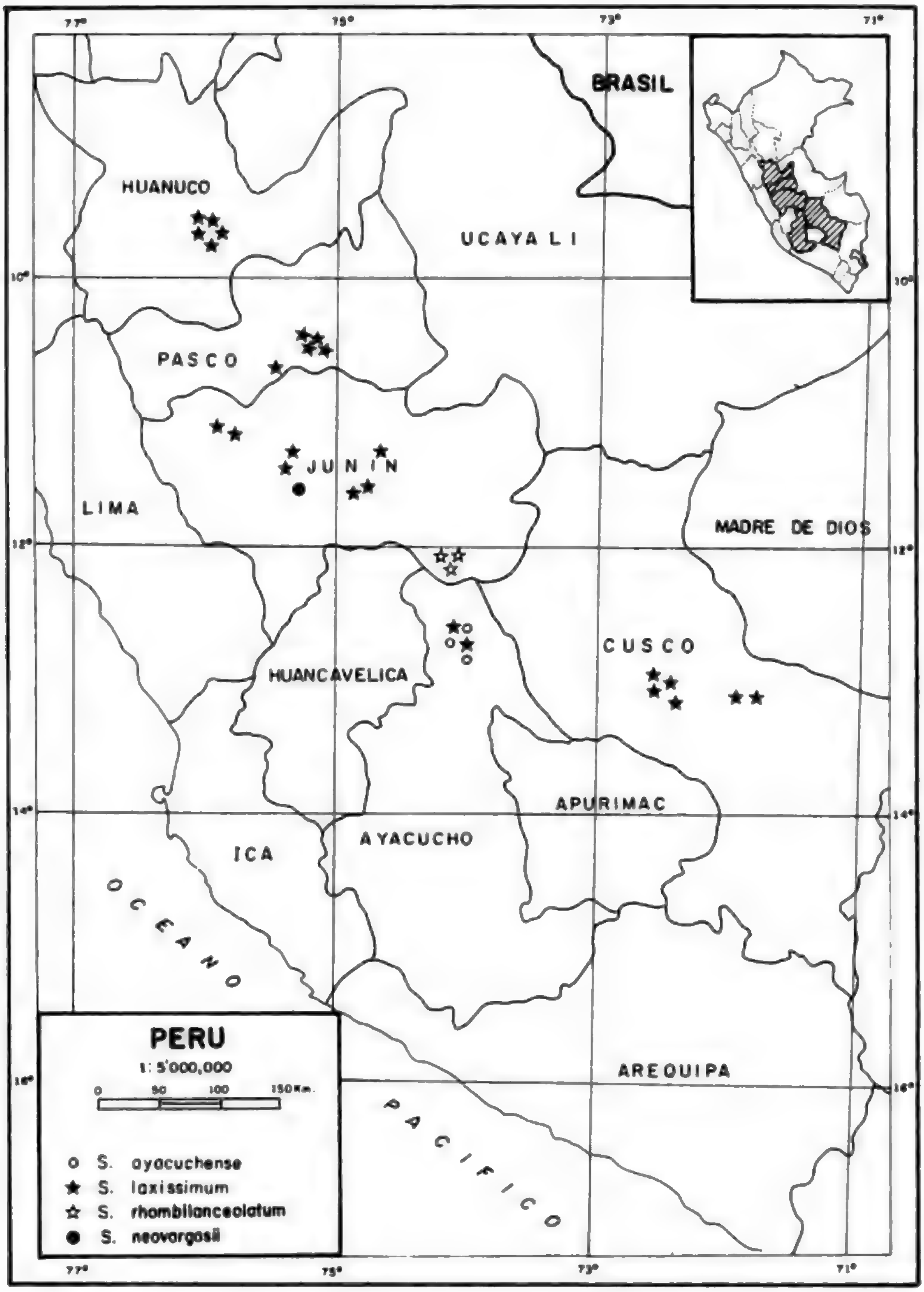

N° 2150
Solanum ayacuchense Ochoa
Tanta Yanta, 2900- 3000 m. provincia de La Mar, departamento de Ayacucho. Febrero 11, 1958.
Col. et det. : C. Ochoa

Figure 21. *Solanum ayacuchense* Ochoa (*Ochoa 2150*, holotype).



Map 5. Distribution of *Solanum ayacuchense, S. laxissimum, S. neovargasii* and *S. rhombilanceolatum.*

4. *Solanum buesii* Vargas, Rev. Argentina Agron. 10(4):396-397, 1943.

Fig. 22-25; Map 6; Plate II.

Plants usually 60-90 cm tall, less frequently 150-200 cm tall, erect to erect-ascending, coarsely pilose. Stem robust 7-10(-15) mm in diameter at the base, simple or branched, sparsely pilose, flecked with purple, with straight wings 1-2 mm wide; internodes (2.5-)4.0-7.0 cm long. Stolons 50-100 cm or more long; tubers round to ovoid, slightly compressed, 3-4 cm long, whitish-yellow with large lenticels, 1.5-2.0 mm, flesh typically white. Leaves coarse and densely pubescent on both sides, hairs simple, shining and unequally long; glandular

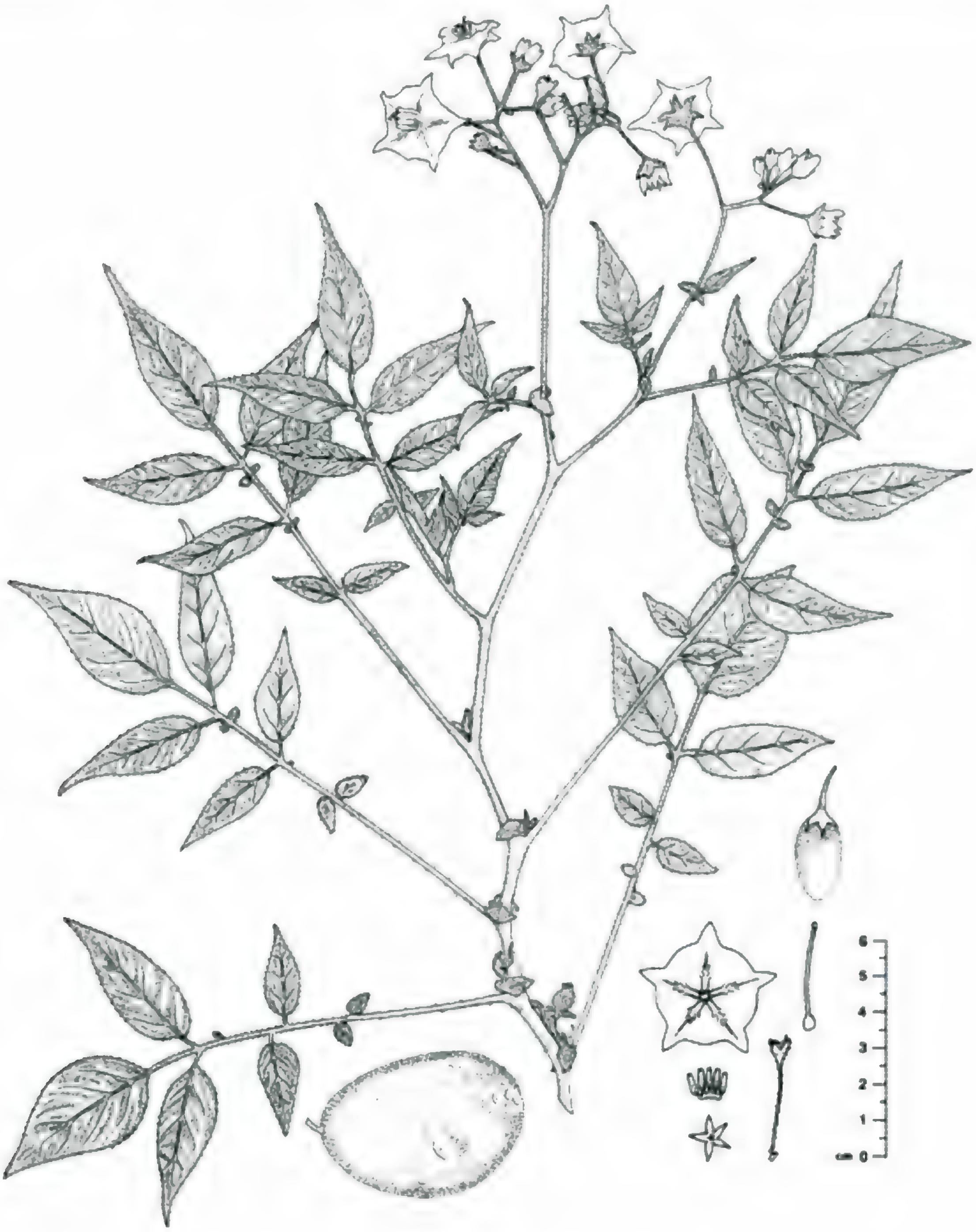


Figure 22. *Solanum buesii* (*Ochoa* 13629).

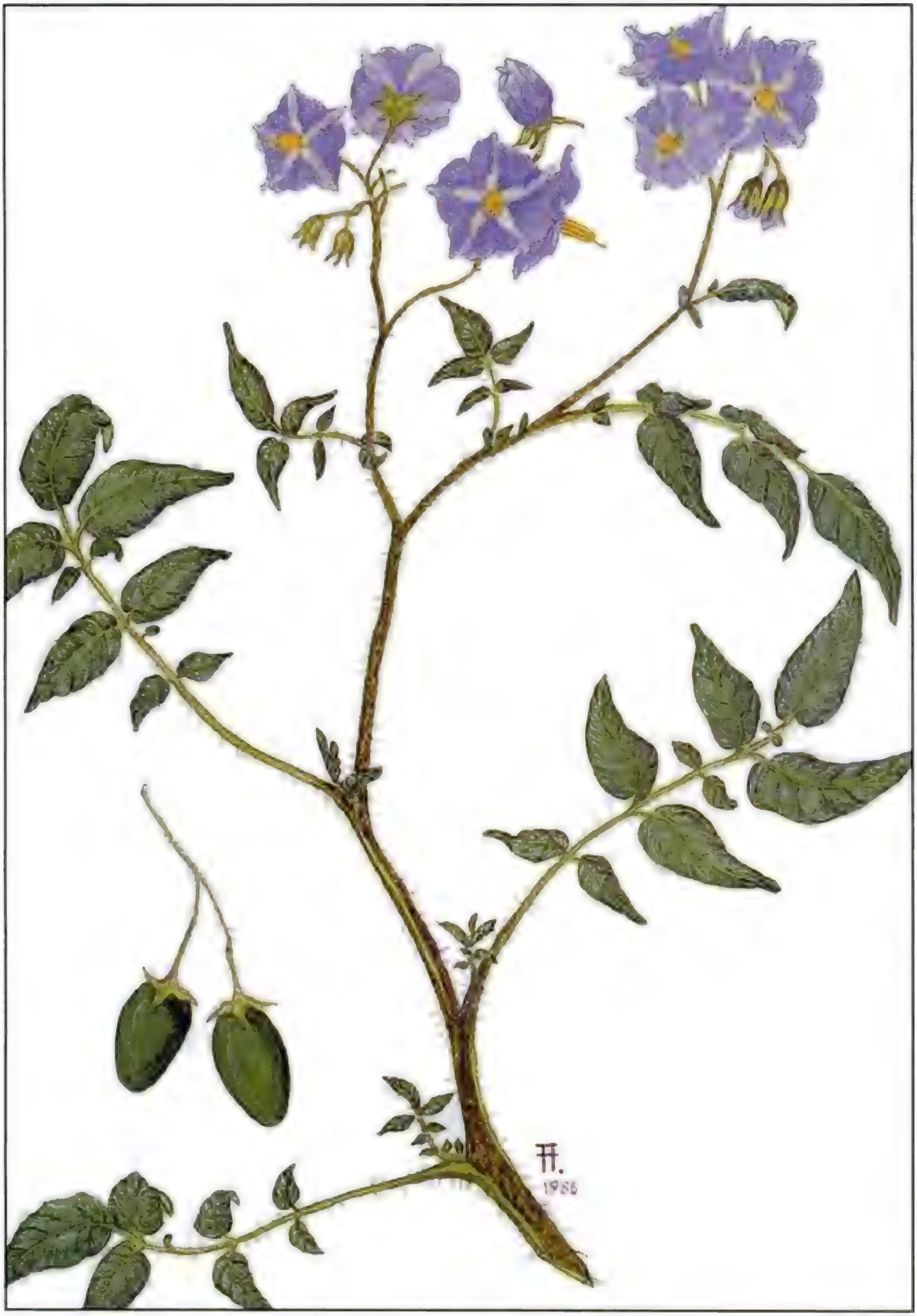


Plate II. *Solanum buesii* Vargas.

hairs short, 4-lobed and fairly sparse, covering the veins and veinlets on the upper surface as well as the rachis and leaf axils. Leaves imparipinnate (11.5-) 21.0-31.5 cm long by (5.5-)14.5-19.0 cm wide, with (2-)3-4(-5) pairs of lateral leaflets and 2-4(-7) pairs of interjected leaflets; leaflets elliptic-lanceolate or lanceolate, the apex pointed to long acuminate and the base cuneate to obliquely rounded, on petiolules (2-)5-8(-12) mm long; terminal leaflet slightly larger than the laterals, (4.5-)6.5-8.0(-9.0) cm long by (1.5-)2.6-3.0(-3.6) cm wide, occasionally with one small orbicular interjected leaf on the petiolule; the first pair of leaflets (3.0-)4.5-0.0(-7.3) cm long by (1.2-)1.5-2.0 (2.0) cm wide, subsessile; interjected leaflets 2-15 mm long by 2-3 mm wide, the larger elliptical and subsessile and the smaller suborbicular and sessile. Pseudostipular leaves broadly falcate to semiovate, 10-17 mm long by 6-8 mm wide. Inflorescence cymose to cymose-paniculate, 10-15 flowered; peduncle (5-)10-12 cm long by 2.5-3.5 mm in diameter at base, pubescent; pedicels 15-25 mm long, densely pubescent like the calyx, articulated about 7-8 mm below calyx. Calyx densely pilose, with white setiform hairs, asymmetrical, rarely symmetrical, pigmented, 7-8 mm long; the lobes ovate-lanceolate and abruptly acuminate, acumens pointed, to 1.5 mm long. Corolla purple-lilac, 3.0-3.5 cm in diameter, rotate-pentagonal or almost rotate-stellate because of the prominently long acumens (Fig. 23), coarsely pubescent on the apical margins. Anthers narrowly lanceolate, pale yellow, long, 7.5-8.0 mm in length, base cordate; filaments 1 mm long, sparsely setose. Style 9.5-10.5 mm long, scarcely exerted, very slender or filiform, densely papillose on the basal one-third of its length; stigma capitate, very small, scarcely thicker than the apex of the style. Fruit long-conical, to 3 cm long (Fig. 22), uniformly dark green or occasionally green with one or two vertically-oriented purple streaks. Chromosome number 2n=24. EBN=2.

Type: PERU. Department Cusco, Province Urubamba, in the ancient ruins of Puyupata, 3600 m alt., on soils disintegrated from granite, 5 August 1942, *C. Vargas C. 2877* (CPC, CUZ, LL, OCH).

This species varies in habit depending upon altitude, humidity and soil type. It grows from 20 cm tall (*OCH-14368*) to nearly 2 m (*OCH-13638*).

Affinities

Solanum buesii is closely related to *S. burkartii* of extreme northeastern Peru notwithstanding the great distance that separates these two. Although the habit of the plant is larger and more vigorous in *S. burkartii*, the two share a common leaf shape and have the same number of leaflets that are nearly similar in form. They differ radically in corolla shape, as well as in the size and shape of their tubers.

Habitat and Distribution

Solanum buesii grows in a phytogeographic formation in Peru known as the *Ceja de Montaña*. This is a very humid zone, and is associated with a rich and varied vegetation. Its major area of concentration lies in the vicinity of the Urubamba Canyon, between Torontoy and Machu Pikchu, in the Province of Urubamba, Department of Cusco (Fig. 24). The eastern part of its range extends to Panticalla Pass near Huyro, in the Province of La Convención, Dept. of Cusco. It occurs at altitudes between 2400 and 3600 m, and is found only in southern Peru.

This species is generally found along the edge of tree forests (*Escallonia*, *Inga*, *Cecropia*) or on steep slopes among thicket shrubs and herbs (*Chusquea*, *Eupatorium*, *Lupinus*, *Calceolaria* and *Rubus*). It not uncommonly grows with *Pteridium aquilinum* and other ferns, as well as with *Masdevalia veitchi* and other orchids. It may also be found with the tuberous species *S. villuspetalum* and *S. santolallae* at elevations between 3000 and 3200 m, or with other non-tuberous species of *Solanum*.

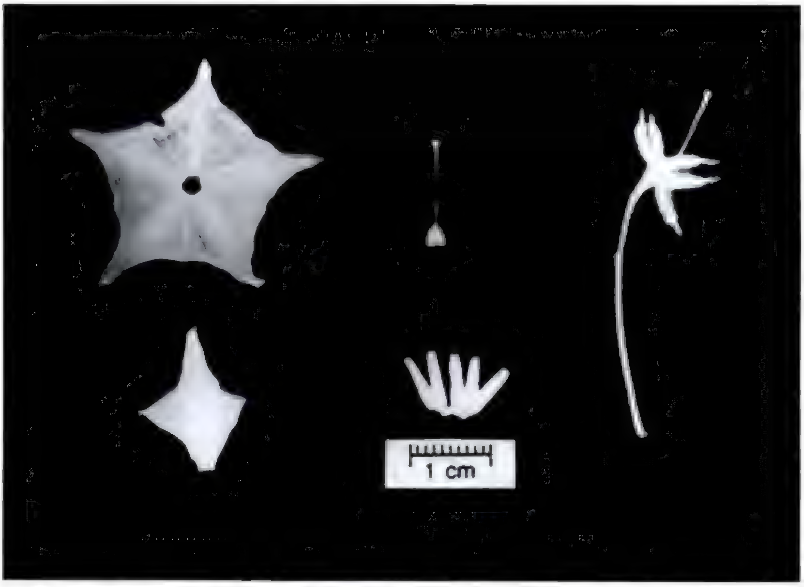


Figure 23. Floral dissection of *Solanum buesii* (*Ochoa 13635*).

Specimens Examined

Department Cusco

Province La Convención: Canchayoc, 3500-3550 m alt., eastern side of the Panticalla Pass, descending the Alpamayo Valley, on hillsides densely covered with shrubby vegetation, plants robust, tubers large, 24 March 1981, *C. Ochoa 14361*, 2n=24 (CIP, GH, MO, OCH, US), *14362* (CIP, GH, MOL, OCH, US) and *14363* (CLP, OCH, US). San Luis, 3200 m alt., above Hacienda Huyro, near km 146 of the Cusco-Quillabamba road, region of the *Ceja de Montaña*, between forest trees, woody shrubs and herbs *(Eupatorium*, *Chusquea*, *Begonia*, many ferns and composites), leaves very pilose, 24 March 1981, C. *Ochoa 14365*, 2n=24 (CIP, OCH, US). Above San Luis in the unilateral ion of Canchayoc on the Chaullay-Puerto Málaga road, 3500 m alt., plants tall, much branched, 24 March 1981, C. *Ochoa 14366* (CIP, OCH). Canchayoc, 3580-3600 m alt., *Ceja de Montaña*, on shrubby mountain slopes, berries long-conical, 2.0-2.5 cm in length, 24 March 1981, *C. Ochoa 14367*, 2n=24 (CIP, OCH), *14368* (CIP, MOL, OCH) and *14369* (CIP, OCH).

Province Urubamba: Torontoy, 3000 m alt., Urubamba Valley, 1 May 1915, *H. Bingham 556* (US). Torontoy, 2400 m alt., Urubamba Valley, 14 May 1915, *H. Bingham* 722 (US). Archaeological ruins of Puyupata Marca, 3600 m alt.,

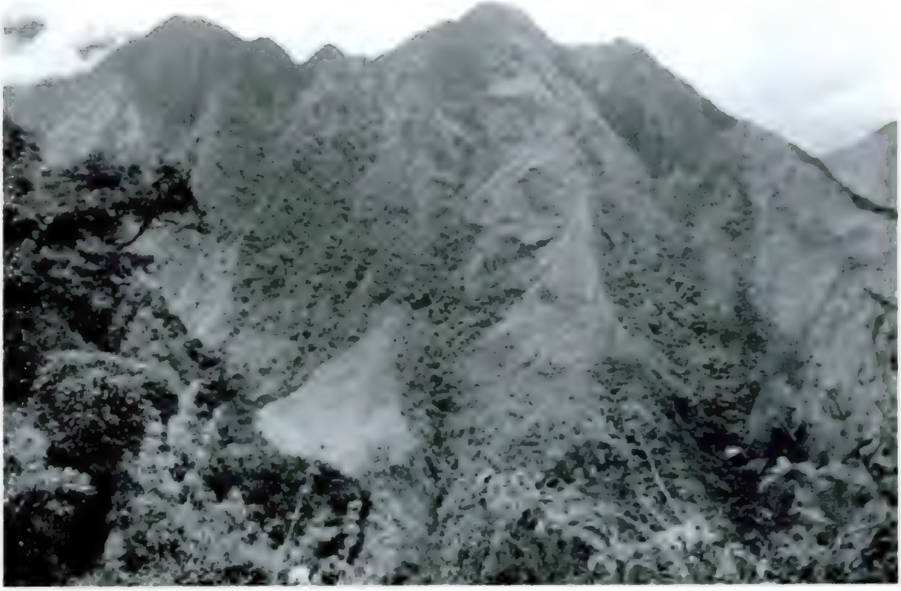


Figure 24. Mountain habitat of *Solanum buesii* between Inti Punco and Wiñay Wayna (2500-3200 m alt.) near the ruins of Machu Pikchu, Cusco.

Ceja de Montaña, in soil of granitic sand, corolla violet, 5 August 1942, *C. Vargas* C. *2877* (CPC, CUZ, LL, type collection of S. *buesii*). Llulluchayoc, 2700 m alt., along the road to the base of Wuayllabamba-Wuarmiwuañuskka, between forest trees (*Escallonia* sp.) and woody shrubs and herbs (various non-tuber bearing *Solanums*, *Salvia*, *Begonia* and many ferns and composites), 19-21 February 1980, C. *Ochoa 13629*, 2n=24 (OCH). Ruins of Rumppu Raccai, *ca.* 3500 m alt., near Wuarmiwuañuskka, among grass plants, shrubs and some trees of *Escallonia* sp., *Ceja de Montaña*, plants up to 1 m tall, branched, 19-21 February 1980, *C. Ochoa 13633* (CIP, GE MO, MOL, OCH, UNTC, USM, US). Sayacc Marca, *ca.* 3300 m alt., near Rumppu Raccai, between forest trees and abundant *Pteridium aquilinum*, 19-21 February 1980, C. *Ochoa 13634* (OCH). Above Puyupata, *ca.* 3550 m alt., along forest margins, in lush growth of *Mintostachys*, *Satureja*, *Calceolaria*, *Lupinus* and various species of grasses and composites, 1921 February 1980, *C. Ochoa 13635* (topotypes CIP, GH, MO, OCH, US). Ruins of Puyupata Marca, 3450-3550 m alt., between the ruins of stone walls or at the base of tall grasses, *Calceolarias*, ferns and many plants of *Fragaria* and canes of *Rubus*, 19-21 February 1980, C. *Ochoa 13637*, 2n=24 (topotypes CIP, GH, MOL, OCH, US). Valdichayocc, 3300-3200 m alt., heading down from Puyupata Marca towards the ruins of Wiñay Wayna, among shrubs of *Chusquea* and *Eupatorium* and some orchids as *Masdevalia veitchi*, 20 February 1980, C.

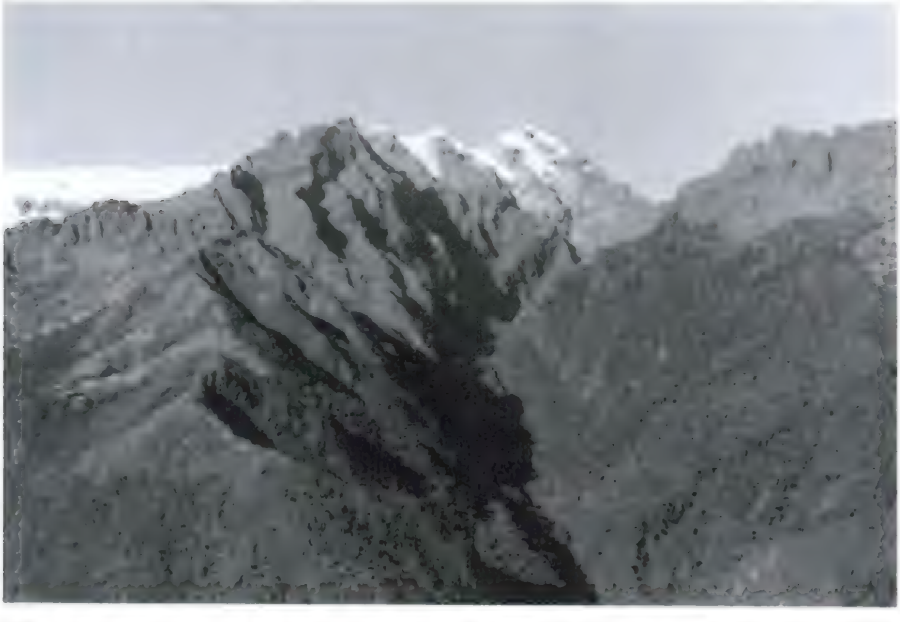


Figure 25. Habitat of *Solanum buesii* at Lucmayok (3600 m alt.), near the east side of the Panticalla Pass, Province of La Convencion, Cusco (Photo: C. Vargas C.).

Ochoa 13638, 2n=24 (CIP, MOL, OCH). Intihuatana, 2800-3000 m alt., heading down from Puyupata to Wiñay Wayna, among woody shrubs, plants to more than 2 m tall, stems thick, 20 February 1980, *C. Ochoa 13639* (CIP, OCH). Puyupata Marca, 3650 m alt., between the crevices of stone wall ruins, 25 March 1983, *C. Ochoa and R. Zachman 15127* (topotype OCH).

Table 5. Fertility of *Solanum buesii* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	2	Conicibaccata	× *S.laxissimum*	55	40	123
24	2	Tuberosa	× *S. bukasovii*	9	9	6
			× *S. goniocalyx*	4	4	50
			× *S. phureja*	7	7	80

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

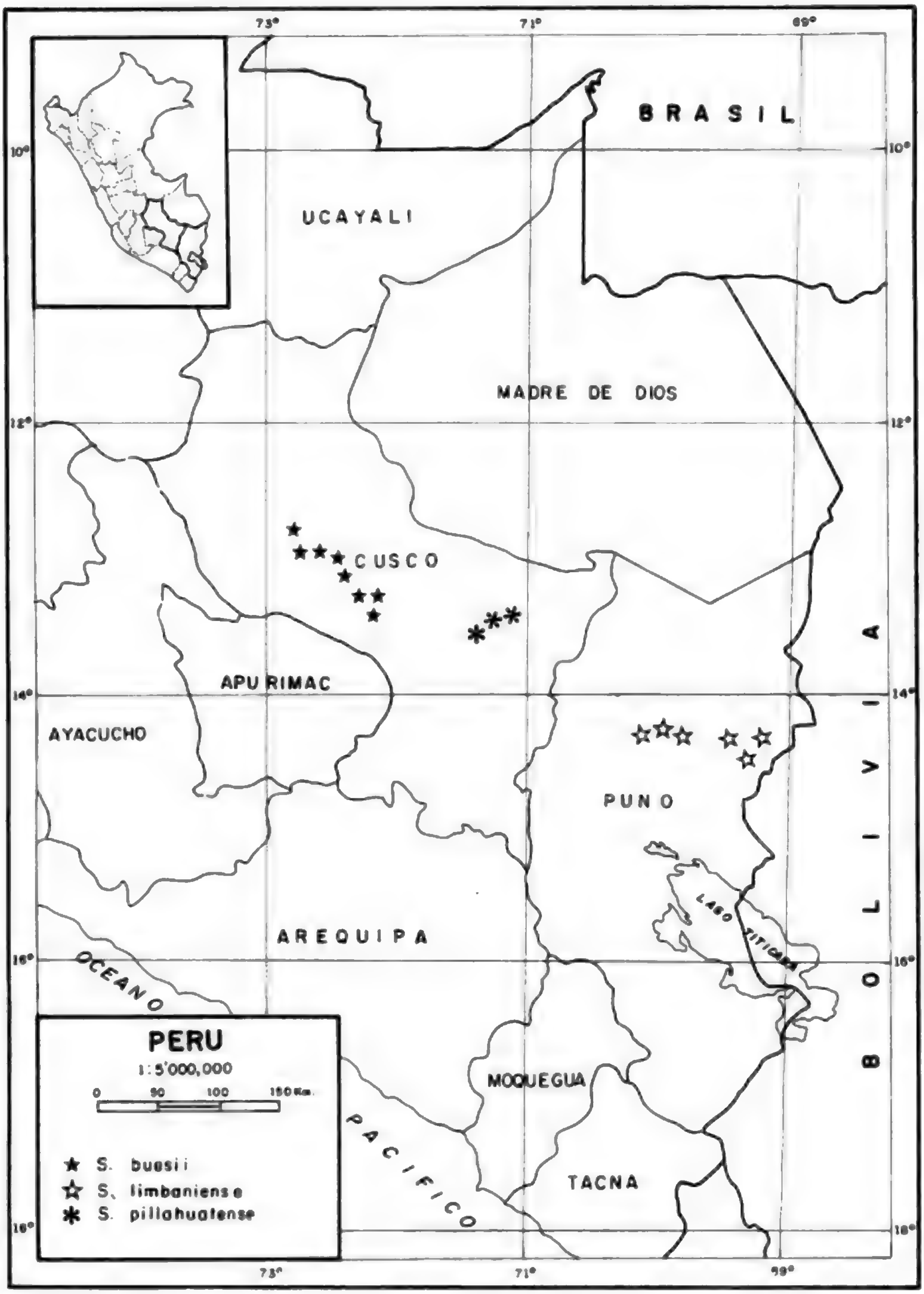
Breeding Potential

The results of crosses of *S. buesii* with diploid species (2n=24) of EBN=2 (1) are shown in Table 5, while source materials are given in Table 6.

Solanum buesii is essentially self-incompatible. Unilateral crosses of *S. buesii* with *S. santolallae* (both diploid members of series Conicibaccata and both EBN=2) were compatible, and yielded a high average number of seeds per fruit. A similar degree of success was not had with *S. bukasovii* of the series Tuberosa, notwithstanding the fact that the unilateral cross is compatible, as only a low average number of seeds was obtained. However, unilateral crosses of *S. buesii* with the cultivated species *S. phureja* and *S. goniocalyx* of series Tuberosa, were not only made with greater ease, but gave a much higher average number of seeds per berry.

Table 6. Collections (OCH) used in *Solanum buesii* fertility studies.

CONICIBACCATA	TUBEROSA
S. buesii 13629, 14367	*S. bukasovii* 13707
S. laxissimum 13706	*S. goniocalyx* 562-85
	S. phureja 15072



Map 6. Distribution of *Solanum buesii, S. limbaniense* and *S. pillahuatense.*

5. ***Solanum burkartii*** Ochoa, Biota, Lima, II(87):97-98, 1977.

Fig. 26-27; Map 7.

Plants robust, erect-ascending to erect-decumbent, from 80-90 cm to 150 cm or more tall, sparsely pilose, hairs simple and the few glandular hairs small and 4-lobed; stem generally branched, 1-2 cm in diameter toward the base, broadly winged, pigmented or subpigmented purple toward the middle or basal third, pilose; hairs 1-3 mm long, multicellular; internodes (2.5-)6.0-9.0(-12.0) cm long. Stolons 1 m or more long, white and fleshy, 2-3 mm in diameter; tubers white, large, 8-12 (-15) cm long and to 2.5 cm in diameter, long and subcylindrical or cylindrical, straight or subfalcate, the apex obtuse and the base pointed, occasionally fusiform. Leaves imparipinnate, covered by short white-silvery hairs above, somewhat more pubescent or puberulent below, large, (17.5-)25.0-35.0(-1.5) cm long by (14.0-)17.5-19.5(-24.0) cm wide, very dissected, with (4-)5-6(-7) pairs of lateral leaflets and 10-12(-15), pairs of interjected leaflets of various size, sessile or slightly decurrent about the rachis (Fig. 27). Leaflets narrowly lanceolate or narrowly elliptic-lanceolate, subacuminate at the apex or acuminate, the terminal leaflet slightly larger or almost the same size as the adjacent laterals, (6.5-) 10.0-12.5 cm long by (2.5-)3.0-4.0 cm wide, base narrowly cuneate and the petiolule generally with 1 pair of small interjects; lateral leaflets of the first upper pair (6.0-)9.5-11.0 cm long by (2.5-)2.8-3.3 cm wide, base asymmetrically rounded with petiolules 1-3(-5) mm long; in the upper leaves the first upper pair of leaflets are sessile or only narrowly decurrent about the rachis. Pseudostipular leaves broadly falcate; 7- 10 mm long by 5-6 mm wide. Inflorescence cymose to cymose-paniculate with 10-15(-20) flowers; peduncle forked or bifurcate (Fig. 27), short, 3.7 cm long, on average, 7.5 cm long by 2.0-2.5 mm in diameter at the base, subpigmented in the basal third, densely pubescent like the pedicels; pedicels short and slender, 15-20 mm long, articulated in the upper third; articulation (4.0-)5.0-5.5 mm below the calyx. Calyx asymmetrical, pigmented, sparsely pilose, small, 5-6 mm long, with the lobes narrowly elliptic-lanceolate and the apex short and pointedly acuminate. Corolla rotate to rotate-pentagonal, 3 cm in diameter, very dark purple with the internal star dark gray, almost shiny black. Anthers narrowly lanceolate, small, 5.0-5.5 mm long, light yellow; filaments short less than 1 mm long with some very short hairs. Style 9 mm long; stigma small and capitate. Fruit long conical with an obtuse apex, 2 cm long by 1.2 cm in dia. at base. Chromosome Number: 2n=24.

Local Name: *Papa del Puro Macho.*

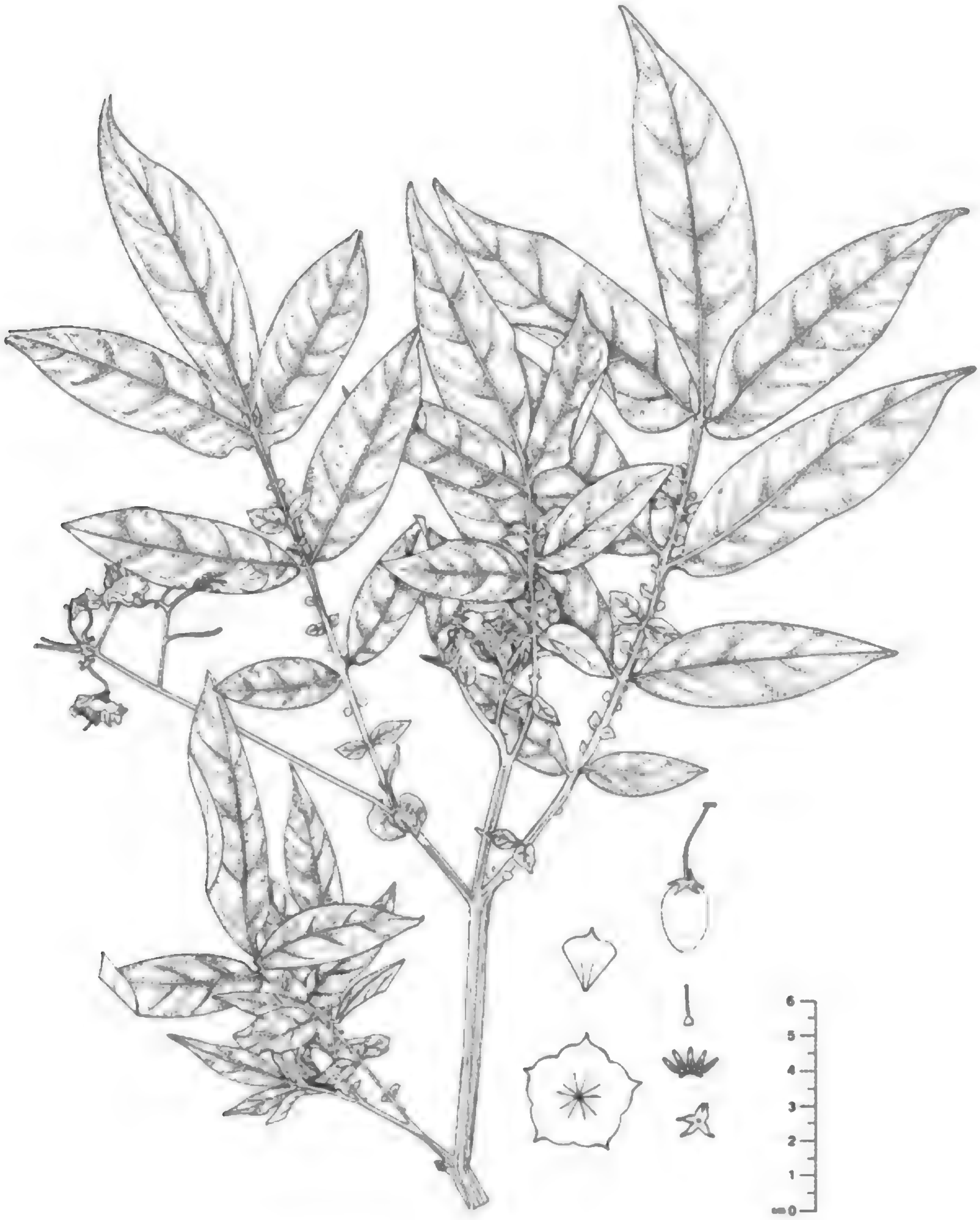


Figure 26. *Solanum burkartii* (*Ochoa 11060*, holotype).

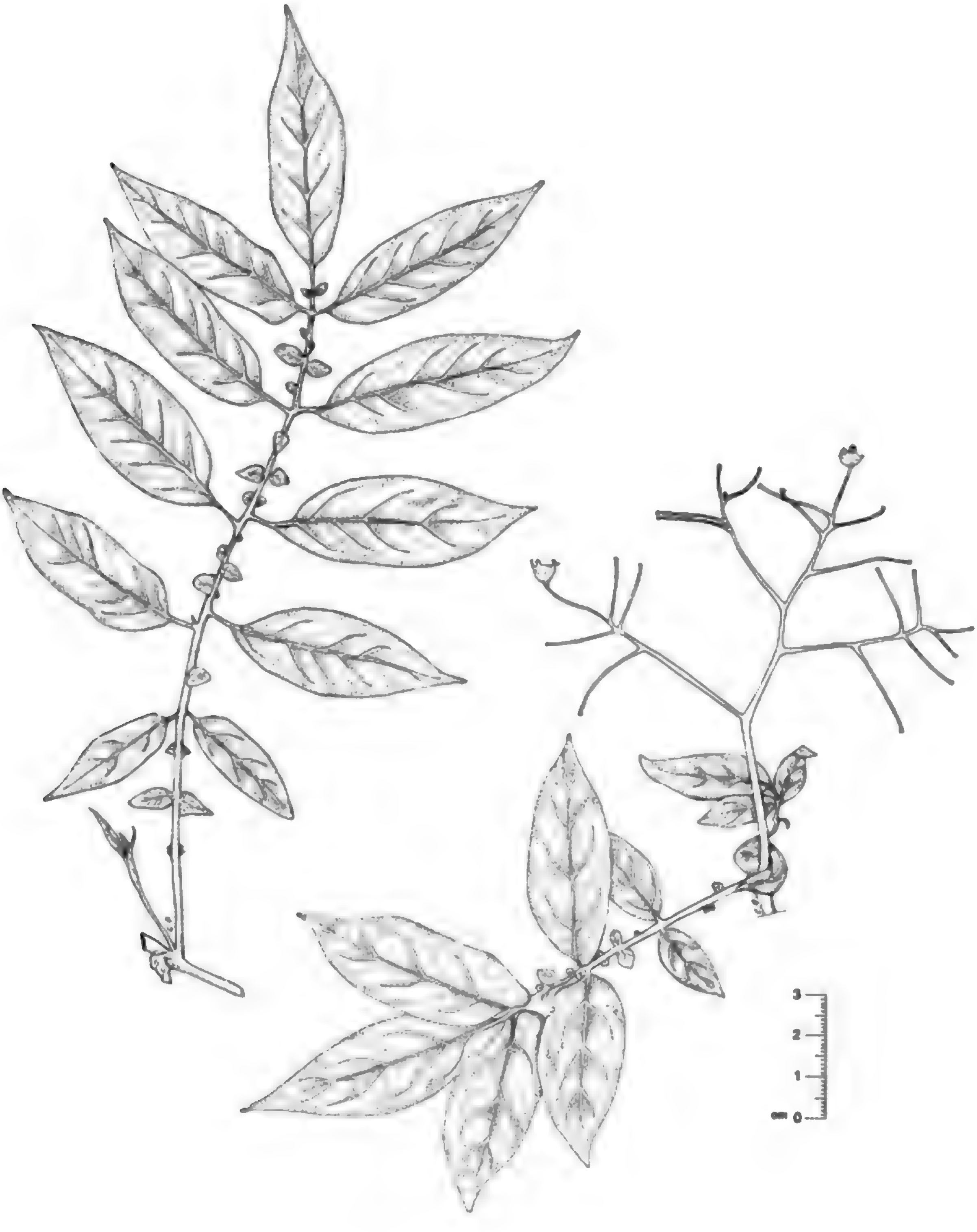


Figure 27. *Solanum burkartii (Ochoa 13246).*

Type: PERU. Department Amazonas, Province Luya, Cutra Cuello, ca. 3000 m alt. among humid forest and brushes, 19 August 1976, C. *Ochoa 11060* (holotype OCH).

Affinities

Solanum burkartii appears to be more closely related to *S. buesii* than to any other tuberous Peruvian species. Thus, both species are similar in having tall, robust, erect-ascending stems, leaves with nearly identical leaflets (although there are more pairs in *S. buesii*), asymmetrical calyces, and long conical fruits.

Habitat and Distribution

Solanum burkartii commonly grows along the margins of tree forests or in thickets of shrubs and herbs. Typically, it occurs in very moist quebradas in soils rich in humus.

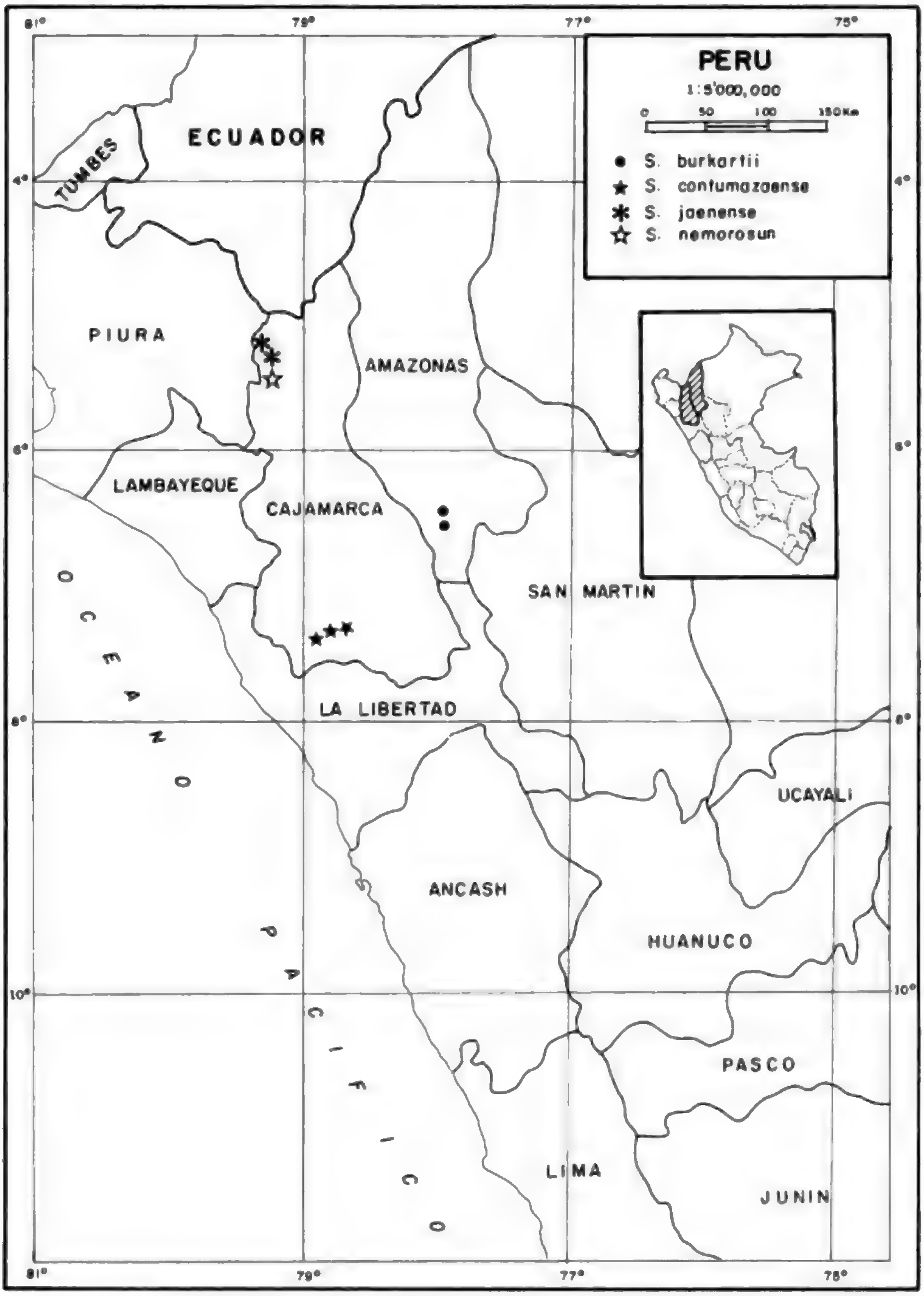
In the areas where this species thrives it is generally associated with melastomes, bamboos (principally *Chusquea* sp.), composites, grasses, begonias and many ferns and terrestrial and epiphytic orchids. Reportedly, it also occurs with *S. chomatophilum* and other tuber-bearing species, but to a much lesser extent.

This species is endemic to the Province of Luya, Department of Amazonas, in northeastern Peru, where it grows at elevations between 2800 and 3000 m (Map 7).

Specimens Examined

Department Amazonas

Province Luya: Cutra Cuello, *ca*. 3000 m alt., in moist forests and thickets with melastomes, *Chusquea* sp., *Urtica* sp., various orchids and numerous ferns, near *S. chomatophilum*, July 1976, *C. Ochoa 11060* (OCH, type collection of *S. burkartii*). Between Chontapampa and Cutra Cuello, 2800 m alt., in a very moist, forested and thicketed quebrada in soils rich in humus, plants robust, erect-ascending, to nearly 2 m tall, leaves large and very divided, tubers large, long and subcylindrical, up to 15 cm long and 2.5-3.0 cm in dia., 31 March 1979, *C. Ochoa and Z. Maycelo 13246*, $2n=24$ (OCH). Vicinity of Cutra Cuello, plant propagated 18 November 1982 in the greenhouse at La Molina, Lima, from tubers originally collected and sent in by Z. Maycelo, without date or number (OCH).



Map 7. Distribution of *Solanum burkartii, S. contumazaense, S. jaenense* and *S. nemorosum*.

6. ***Solanum contumazaense*** Ochoa, An. Cient. Univ. Agr. Lima, 2(2):148-151, illustr., 1964. Fig. 28-31; Map 7; Plate III.

Plant erect 50-70(-100) cm tall, covered entirely by simple, white-hyaline, multicellular hairs, 2-3 mm long and short, sparsely distributed glandular and tetralobular hairs. Stem cylindrical, simple or branched, vigorous, 6-12 mm in dia. at base, wingless; internodes (1.5-)2.5-5.0 cm long, pigmented light brown in the basal one-third of its length and flecked with brown toward the mid section or upper one-third of its length; stolons 50-80 cm long, very slender, 1.5-2.0 mm in dia., white; tubers irregular, round to ovoid or elongated, 1.5-3.5(-4.5) cm long (Fig. 30), whitish-yellow, with numerous lenticels and shallow to deep eyes, flesh white. Leaves pubescent on both sides, including the rachis and the petioles, (7.0)11.0-16.5 (-19.0) cm long by (4.0-)5.5-7.5(-8.5) cm broad, imparipinnate, with 4-5 pairs of lateral leaflets and (2-)4-8(-10) pairs of interjected leaflets. Leaflets elliptic-lanceolate, the apex pointed or shortly acuminate and the margins entire, repand or subcrenulate. Terminal leaflet more broadly elliptic-lanceolate and somewhat larger than the first pair of laterals, 3.5-7.0 cm long by 1.5-3.5 cm broad with a subcuneate or broadly rounded base; the lateral leaflets diminishing gradually in size toward the base, subsessile or shortly petiolulate, on rounded or asymmetrically rounded bases, the first pair of leaflets 3-5 cm long by 1.5-2.5 cm broad, narrowly decurrent about the rachis. Interjected leaflets of various size, 2-14 mm long by 1-6 mm broad, narrowly lanceolate, the apex subobtuse and the base sessile. Pseudostipular leaves falcate or narrowly and asymmetrically elliptic-lanceolate, on petiolules, 8-12 mm long. Inflorescence lateral and terminal, cymose-paniculate, 10-35 flowered, or more. Peduncle short 2.5-4.0 cm long by 1.5-2.0 mm in dia., densely pilose like the pedicels and the calyx, lightly brownish-flecked; pedicels 20-25 mm long, articulated near center or up to 9-12 mm below base of calyx; pigmented similarly to the calyx above the articulation and light green beneath. Calyx asymmetrical, densely pilose, large, 10-12 mm long; lobes narrowly elliptic-lanceolate or ovate-lanceolate, abruptly narrowed to long acumens, very narrow, almost filiform, pointed or subspatulate. Corolla rotate, white to creamy-white, 3.0-3.5 cm in dia., with the internal star yellowish-green, acumens short, the margins densely pubescent. Anthers lanceolate, pale yellow, 5-6 mm long; base of anthers with a yellowish-green excrescent that extends toward the apex of the filament; filaments white-hyaline, slender, 2-3 mm long, glabrous. Style 10-11 mm long, exerted 4 mm, sparsely papillose below center; stigma claviform, light green. Fruit long conical, the apex pointed (resembling some forms of *Capsicum)*, 3.5-4.0 cm long by 1.5 cm in dia. at base, green to dark green, irregularly diffused with pale violet and lightly flecked with white dots, not verrucose. Chromosome number: 2n=24. EBN=2.

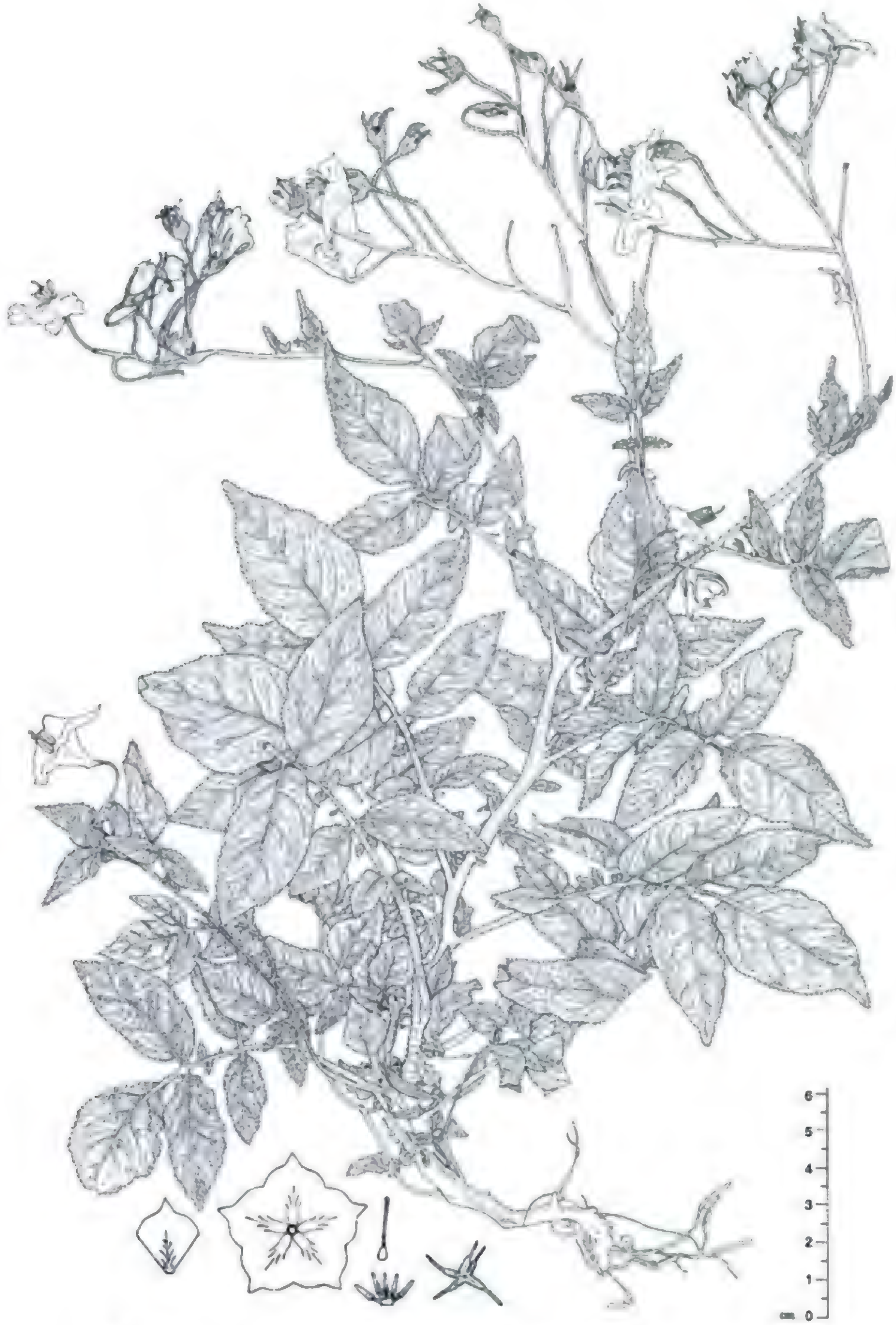


Figure 28. *Solanum contumazaense* (*Ochoa 2485*, holotype).

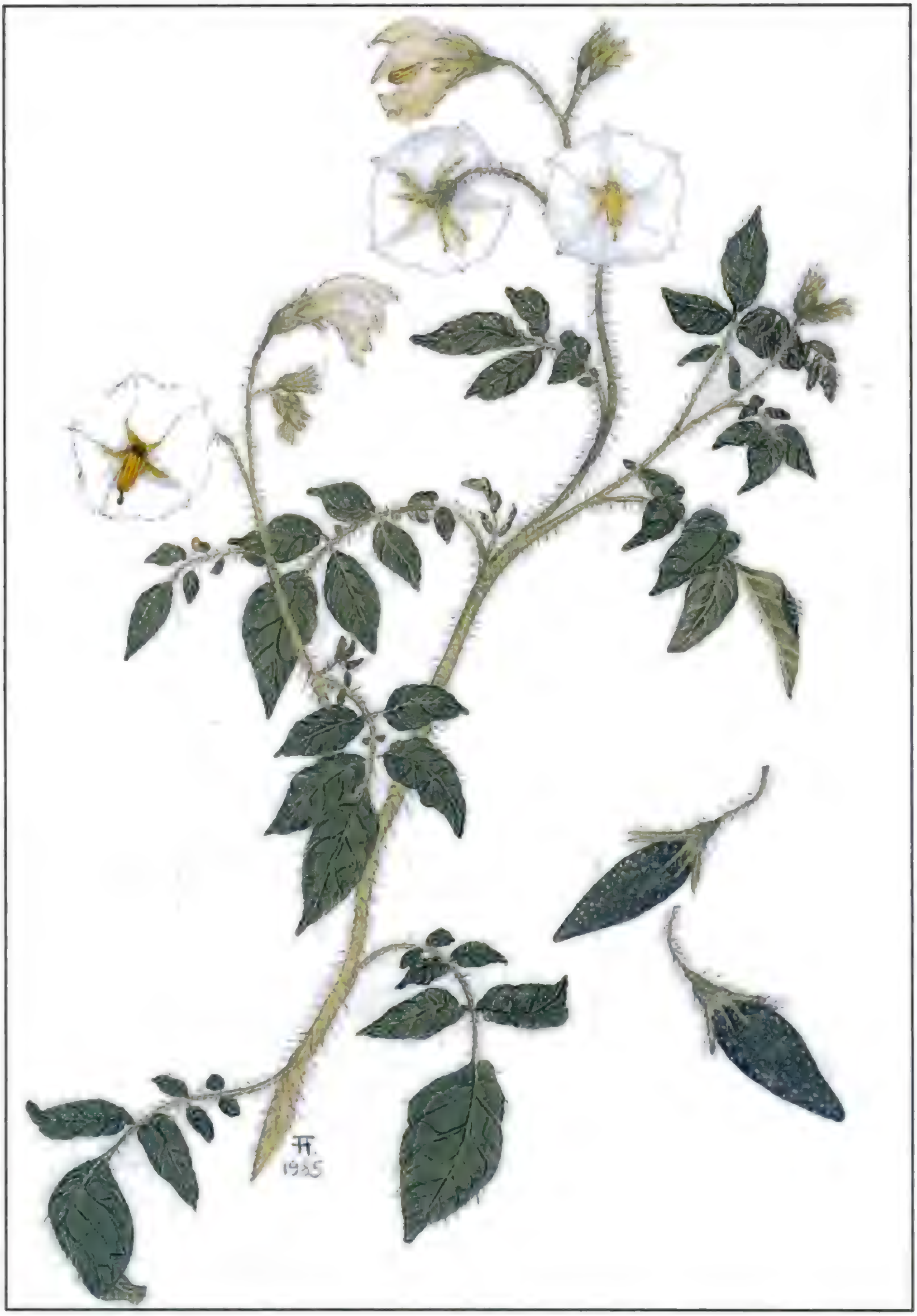


Plate III. *Solanum contumazaense* Ochoa.

Type: PERU. Department Cajamarca, Province Contumazá, foothills of Cerro Chungarrán, 2840 m alt., near Puquio, 10 April 1963, *C. Ochoa 2485* (holotype OCH, isotypes GH, LE, MO, US).

Affinities

Solanum contumazaense resembles *S. wittmackii* in being densely pilose and in having similar-appearing leaflets and interjected leaflets. However, the two species are very different in fruit shape, as well as in the size and color of their corollas. On the other hand, one must call attention to the fact that the habit and leaves of *S. contumazaense* are extraordinarily like those of the common tomato.

Habitat and Distribution

Solanum contumazaense inhabits shrubby slopes and herbaceous thickets. It often grows in moist soil among large rocks, where it may be associated with *Lycopersicon peruvianum* var. *dentatum*, *Passiflora*, *Lupinus*, *Calceolaria*, *Solanum chiquidenum* and other tuberous species, and various members of the Compositae such as *Bidens*. This species is endemic to the Province of Contumazá (Fig. 31), Districts of Cascas and Guzmango, in the Department of Cajamarca in northern Peru (7°72' S by 78°53'W), where it grows at an altitude between 2700 and 2800 m (Map 7).

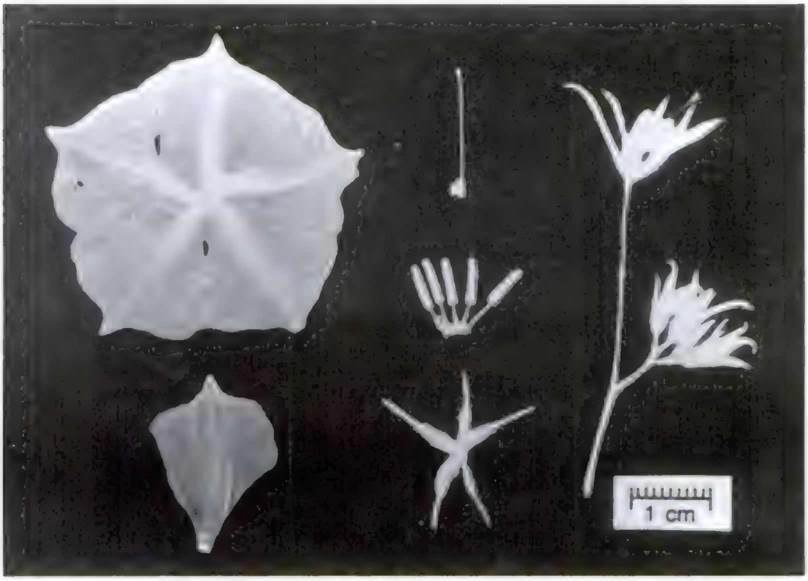


Figure 29. Floral dissection of *Solanum contumazaense* (*Ochoa 13969*).

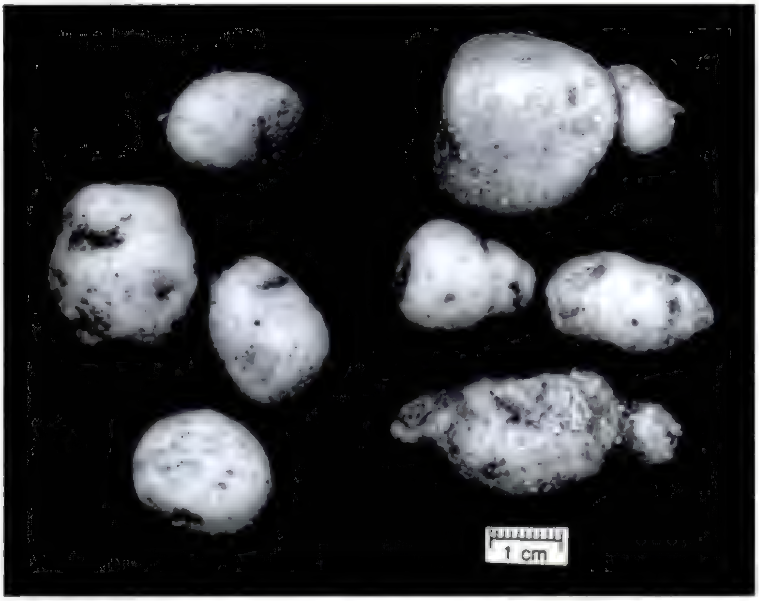


Figure 30. Tubers of *Solanum contumazaense* (*Ochoa 14751*).

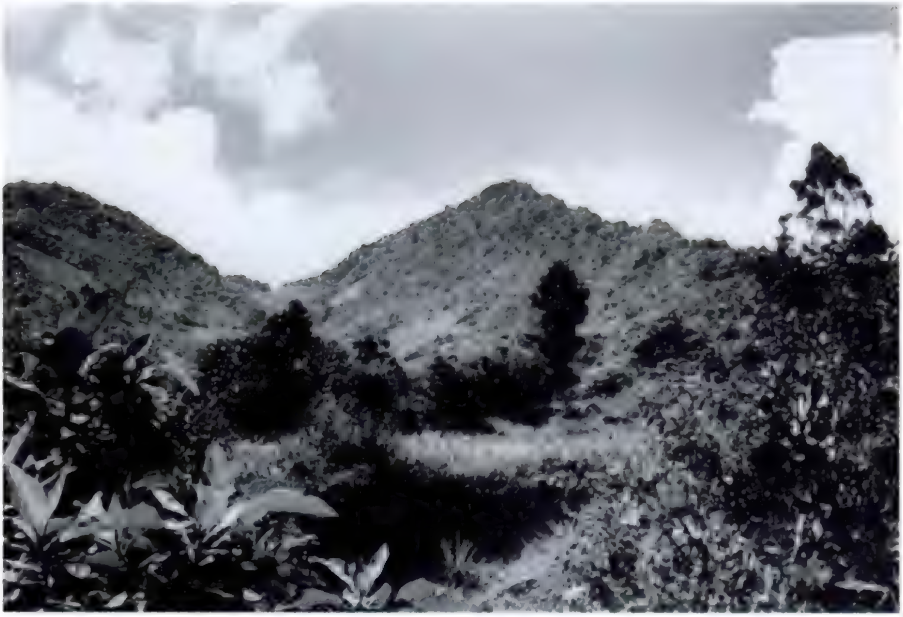


Figure 31. Habitat of *Solanum contumazaense* at Cerro Chungarrán, above Guzmango, Province of Contumazá, Cajamarca.

Specimens Examined

Department Cajamarca

Province Contumazá: Cascas, 2500 m alt., tuber-bearing herb with white flowers, among rocks, 20 May 1962, *A. López, A. Sagástegui, and I. Sánchez 3716* (F, HUT, OCH). District Guzmango, foothills of Cerro Chungarrán, 2840 m alt., near Puquio, 10 April 1963, *C. Ochoa 2485*, 2n=24 (GH, LE, MO, OCH, US, type collection of *S. contumazaense*). Near the hamlet of San Martín, 2720 m alt., on lower slopes of Cerro Lledén, a distance of several km by foot along the trunk road Cascas-Contumazá, associated with *Lycopersicon peruvianum* var. *dentatum* Dunal, *Passiflora* sp. and grasses, 13 May 1980, *C. Ochoa 13969* (CIP, OCH). Heading up from Guzmango to Cerro Chungarrán, near Puquio, 2800 m alt., among large rocks in moist soil, flowers white, berries long conical, dark green with white specks, scarce, 14 May 1982, *C. Ochoa 14751*, 2n=24 (CIP, MO, OCH).

Table 7. Fertility of *Solanum contumazaense* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	TUBEROSA	× *S. incahuasinum*	13	2	30
			× *S. mochiquense*	5(22)	0(1)	0(0)
24	2	CONICIBACCATA	× *S. chomatophilum*	79(16)	0(2)	0(0)
24	2	INGAEFOLIA	× *S. jalcae*	14(21)	1(0)	0(0)
24	2	PIURANA	× *S. acroglossum*	11	0	0
			× *S. cantense*	9(15)	0(0)	0(0)
			× *S. paucissectum*	26(59)	1(29)	0(0)
			× *S. piurae*	10	4	0
24	2	TUBEROSA	× *S. goniocalyx*	4	4	0
			× *S. huancabambense*	24	0	0
			× *S. huarochiriense*	8	0	0
			× *S. phureja*	5	0	0

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

The crossability of *S. contumazaense* with diploid (2n=24) species having EBN=1 or EBN=2 is given in Table 7, and the materials used in these experiments is shown in Table 8.

As illustrated in Table 7, the unilateral cross of *S. contumazaense* with *S. incahuasinum* (2n=24 and EBN=1) is the only one that proved successful, although many other attempts were made to cross this plant with other species. Unilateral crosses of *S. contumazaense* with the wild species *S. acroglossum*, *S. huancabambense*, *S. huarochiriense*, *S. piurae* and the cultivated species *S. goniocaklyx* and *S. phureja* (all 2n=24 and EBN=2) proved incompatible. Similarly, no compatibility was found in reciprocal crosses involving either *S. mochiquense* (2n=24 and EBN=1) or *S. cantense*, *S. chomatophilum*, *S. jalcae* or *S. paucissectum* (all 2n=24 and EBN=2).

Table 8. Collections (OCH) used in *Solanum contumazaense* fertility studies.

CONICIBACCATA
S. chomatophilum 11061, 13010, 13012, 13199, 13205, 13210, 13325, 14786, 14787
S. contumazaense 14751

INGAEFOLIA
S. jalcae 13344

PIURANA
S. acroglossum 11297
S. cantense 14746, 14826
S. paucissectum 11628, 11633
S. piurae 13959

TUBEROSA
S. goniocalyx 00001
*S. huancabambense*11619, 11627
S. huarochiriense 14525
S. incahuasinum
S. mochiquense 14870, 15993
S. phureja 15051
S. piurae 13959

7. *Solanum chomatophilum* Bitt., Abhaudl. Naturwiss. Ver., Bremen 25(2):246-248, 1922.

Figs. 32-38; Map 8; Plate. IV.

S. pascoense Ochoa, Agronomía, Lima, 26: 112-113, illustr., 1959.

Plants usually bushy, erect to erect-ascending, occasionally rosette-forming or subrosettle-like at base, (10-)30-50(-90) cm tall, essentially glabrous or very rarely sparsely pilose. Stem simple or branched from the base, erect or somewhat flexed, 2-7 mm in diameter, cylindrical, without wings or very narrowly and inconspicuously winged, darkly or slightly pigmented purple or violet; internodes (0.5-)1.5-3.0(-6.0) cm long. Stolons 1.0-1.5 m long, thick, 3-5 mm in diameter, fleshy, white, rhizomatous, frequently forming other adventitious plants, usually without tubers; tubers, when present, very small, 1-2 cm long, ovoid to long, subcylindrical or submoniliform (Fig. 37), white. Leaves (2.5-)8.0-16.0(-23.0) cm long by (1.5-)5.0-10.0(-13.0) cm broad, very frequently 11-13 cm long by 6.0-9.5 cm broad, imparipinnate, usually with (2-)3-(-5) pairs of leaflets and 0-3 pairs of interjected leaflets (Fig.32), less frequently, but always on the lower third of the plant, with 6 or more pairs of leaflets and 7 or more pairs of interjected leaflets (Fig. 33), leaves green to dark green and slightly vernicose above, and lighter green with less violet pigment on the lower leaf surface and rachis, glabrous or glabrescent on both sides, rarely sparsely pilose; hairs when present, simple and very short, mixed with a few 4-lobed glandular hairs principally on the rachis, leaf axils, the petioles and the petiolules. Leaflets elliptic-lanceolate or broadly elliptic-lanceolate to ovate-elliptic, terminal leaflet slightly larger than the lateral leaflets, (1.0-)3.0-0.5(-8.0) cm long by (0.5-)1.5-3.0(-3.5) cm broad, the apex obtuse to subpointed, or shortly acuminate or rounded like the lateral leaflets and the base cuneate and very narrowly decurrent about the 7-12 mm long petiolule. Lateral leaflets obliquely rounded or rounded at base, shortly petiolulate, diminishing gradually in size toward the base; leaflets of the lowermost pair much smaller and sessile; the first pair of lateral leaflets (0.6-)2.0-0.0 (-7.0) cm long by (0.3-)1.02.5(-2.8) cm broad, narrowly decurrent about the rachis on the basiscopic side; interjected leaflets suborbicular to ovate or elliptical, small, 1-6 mm long, sessile. Pseudostipular leaves broadly falcate, small, 2.5-4.0(-10.0) mm long by 1.0-2.5(6.0) mm wide. Inflorescence cymose-paniculate, 6-10 flowered. Peduncle 5-10 cm long, slender, 1.5 mm in diameter at base, glabrous like the pedicels and the calyx; pedicels 15-25(-30) cm long, enlarging conspicuously toward the calyx, articulated above center, about 5-7 mm below the base of the calyx. Calyx symmetrical, glabrous or subglabrous, pigmented dark purple, small, 5.5-7.0 mm long, lobes ovate-triangular to ovate or shortly ovate-lanceolate, apiculate or rarely shortly acuminate, with scarious margins. Corolla rotate-pentagonal to rotate (Figs. 34 and 35), rarely broadly rotate-stellate (var. *subnivale)*, 3-4 cm in diameter, usually violet or lilac, less frequently purple or blue-violet. Staminal column cylindrical-conical, symmetrical; anthers 6 mm long, narrowly elliptic-lanceolate; filaments 1.5-2.0 mm long, 0.9 mm wide, glabrous or shortly pilose externally, white-hyaline or pigmented pale lilac. Style 10 mm long, white-hyaline or pigmented pale lilac toward the base, densely papillose in the lower two-thirds of its length; stigma capitate, cleft, slightly thicker than the apex of the style. Ovary long-conical 2.3 mm long by 1.7

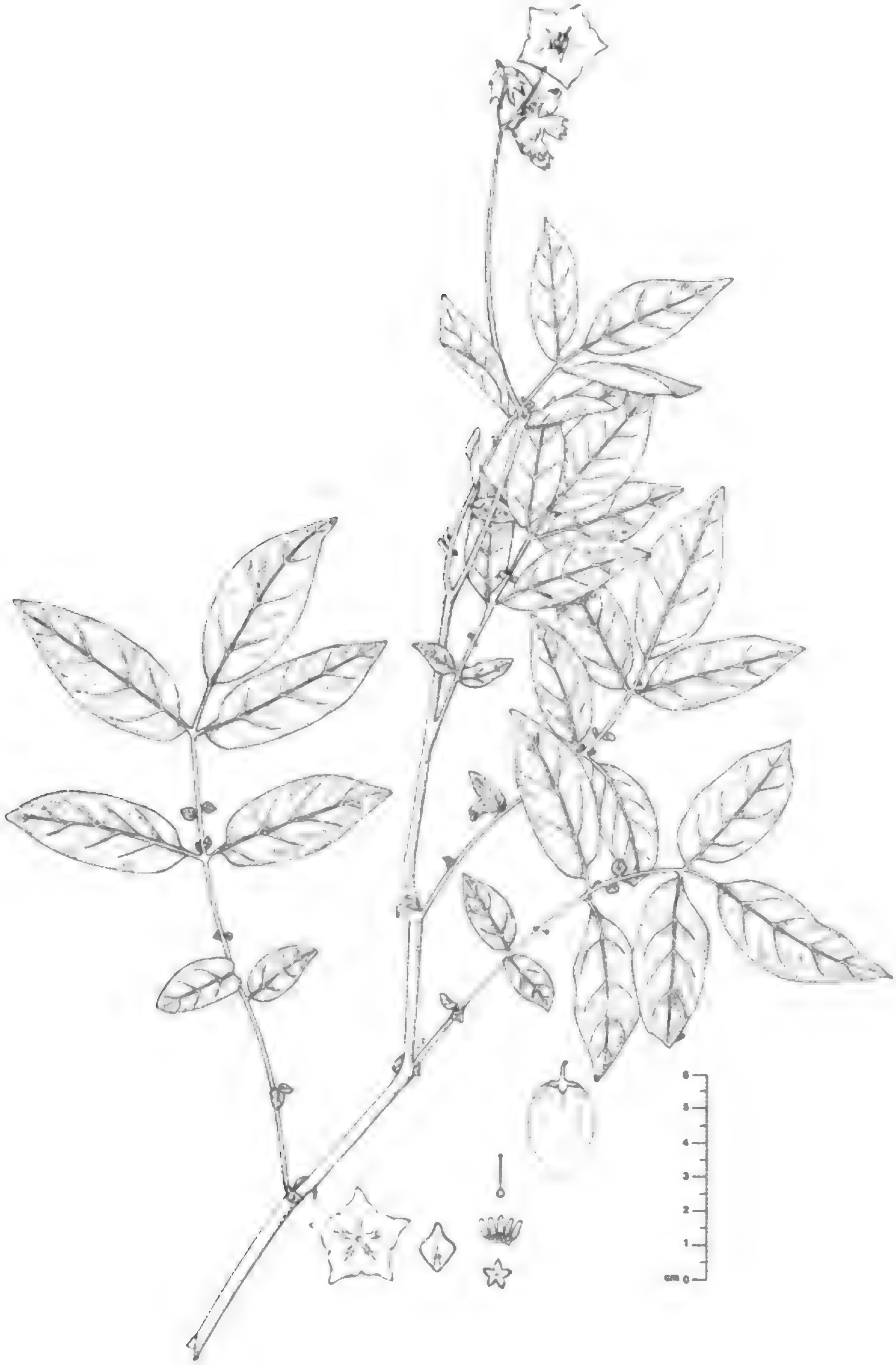


Figure 32. *Solanum chomatophilum* (*Ochoa et Hawkes 2559*, topotype).

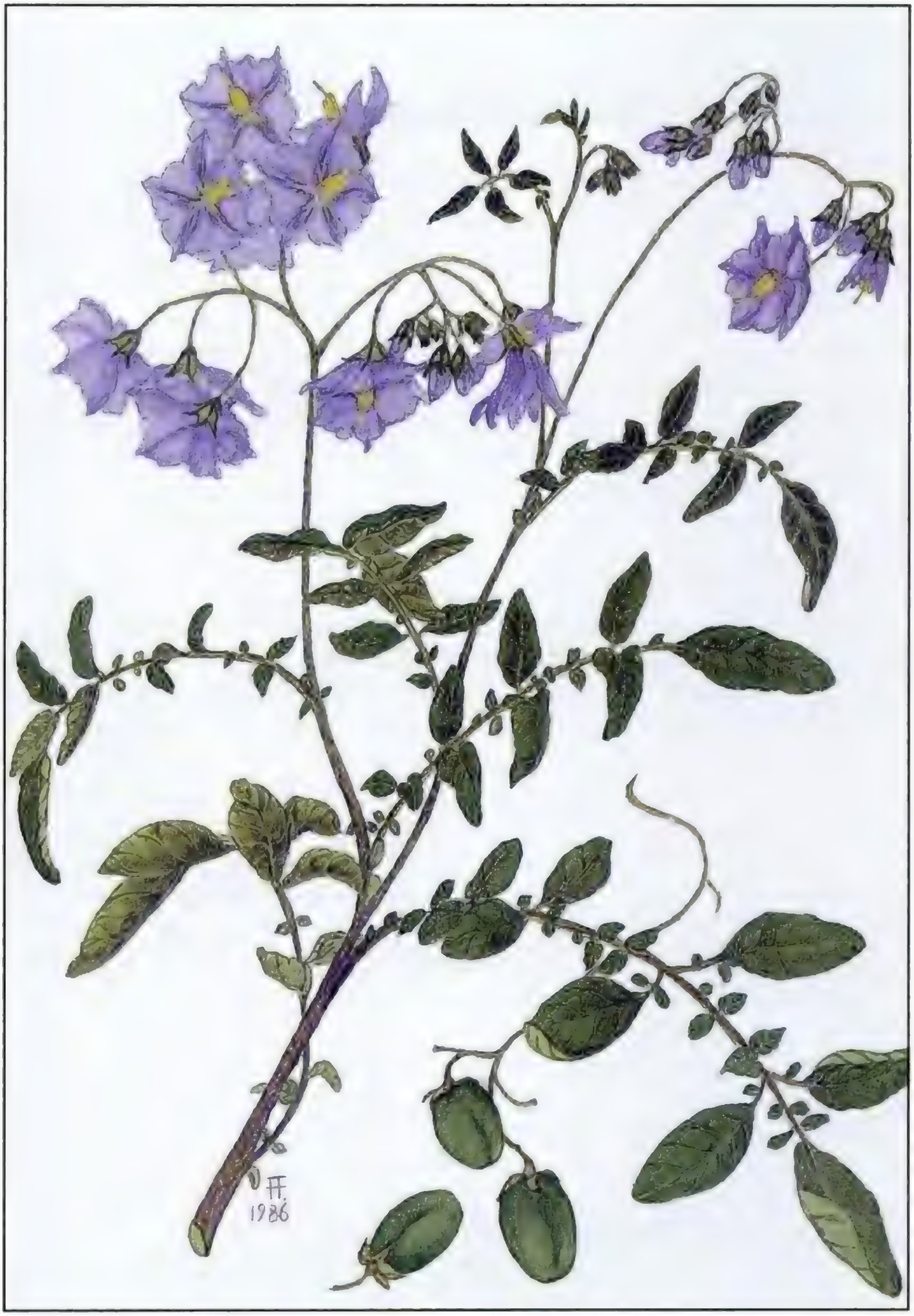


Plate IV. *Solanum chomatophilum* Bitt.

mm in diameter at the base, pigmented or slightly pigmented purple. Fruit long-conical, the apex pointed, or subobtuse, dark green, 2.5-3.0 cm long by 1.5-1.8 cm in diameter at base. Chromosome Number: 2n=24. EBN=2.

Local Names: *Amaa Papa or Pishgo Papa* in the Province Huamalíes, Department Huánuco, and for the fruit, *Cambullo* in Pasto Bueno and Mina de Huaura, Province Pallasca, Department Ancash.

Type: PERU. Department Ancash, Province Pallasca, below Huaura Mine, 3950 m alt., in steppe grassland, among volcanic debris and stones, 23 April 1906, *A. Weberbauer 7201* (B, destroyed; US lectotype, here designated; isotypes F=two sheets, GH=two sheets).

Solanum chomatophilum is extremely variable in habit and leaf dissection, as well as in corolla and tuber size and color. Individual plants may be 30-50 cm tall, without rosette-forming stems, and may have leaves with 3-4 pairs of leaflets and a few interjected leaflets, like that of the grassland type collection of *Weberbauer 7201* and the topotypes of *Ochoa 2344* and *3598* and *Ochoa et Hawkes 2559* (Fig. 32). However, there are also plants that are very small (10-20 cm), with simple erect stems or occasionally with stems forming a rosette at the base and having leaves that are poorly dissected. Such forms are common in the mountains of Puca Ladrillo, Campanario and Shauche in the Province of Rodríguez de Mendoza, Department Amazonas (*Ochoa 2656*, *2661*, *2664* and *2665*), as well as in the open fields of the extensive *jalcas* that are located near km 60 of the Cajamarca-Celendín road. Near Paso de Cumulca of this same road and at elevations ranging between 3400 and 3500 m, there occur large colonies of *S. chomatophilum* that are comprised of very small, rosette-forming plants (10-15 cm), these having floral peduncles that protrude from the stem (*Ochoa 1510* and *1518*). The same forms also occur in the *jalcas* of Sicsimayo, 3500 m, and Huacarumi, 3650 m, Cajamarca (*Ochoa and Salas 16041*, *16042* and 16051).

On the other hand, taller and more vigorous ecotypes of *S. chomatophilum* having leaves that are more highly dissected (up to 5-6 pairs of lateral leaflets and 8 pairs of interjected leaflets) are known from altitudinal zones between 3200 and 3400 m. These forms tend to grow on either steep or gentle mountain slopes, or at lower altitudes, in small quebradas having a milder and more mesophytic climate. Examples of such are encountered along the Cajamarca-Cumbe road (*Ochoa 10728*), the slopes leading up to the jalcas of Sinsi (*Ochoa and Salas 16059*, *16060* and *16061*), and again in the lower portion of Porcón (*Correll and Smith 862*). Representative of this form is the Ochoa collection No. *12511*, from Piedra Grande, 2900 m alt., Province of Celendín, Cajamarca.

The corolla of *S. chomatophilum* varies from rotate (see *Ochoa 13845*, Fig. 35) to rotate-pentagonal (*Ochoa 13292*, Fig. 34), or rotate-stellate in the var. *subnivale*. Though commonly colored violet-lilac or lilac, the corolla can also be purple or blue-violet.

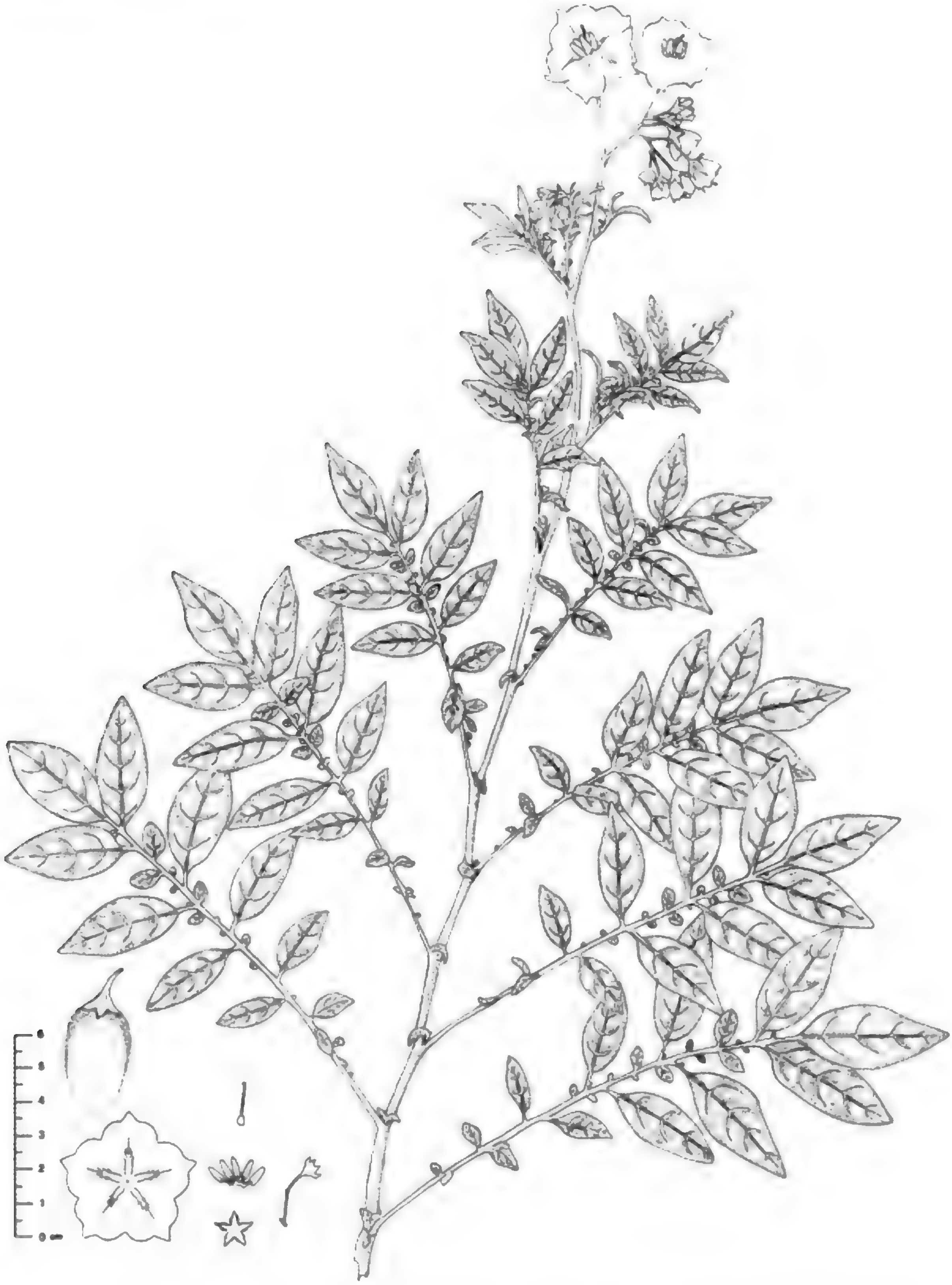


Figure 33. *Solanum chomatophilum* (*Ochoa and Salas 12561*, ecotype with more highly dissected leaves).

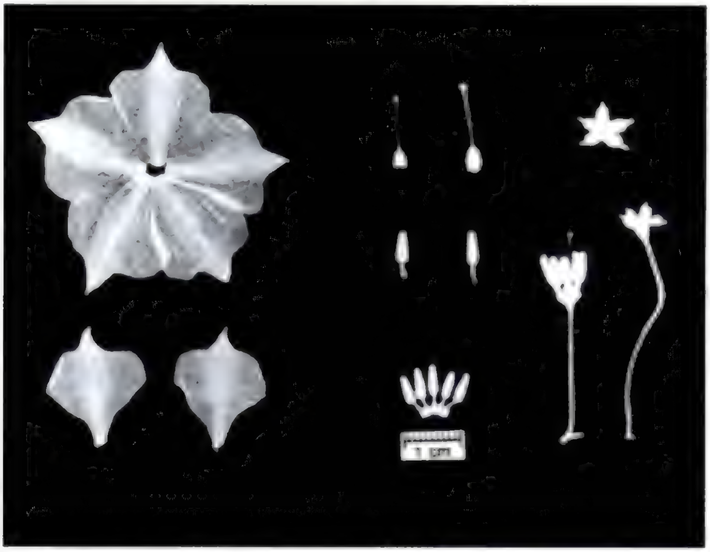


Figure 34. *Solanum chomatophilum.* Corolla rotate-pentagonal (*Ochoa 13292*).

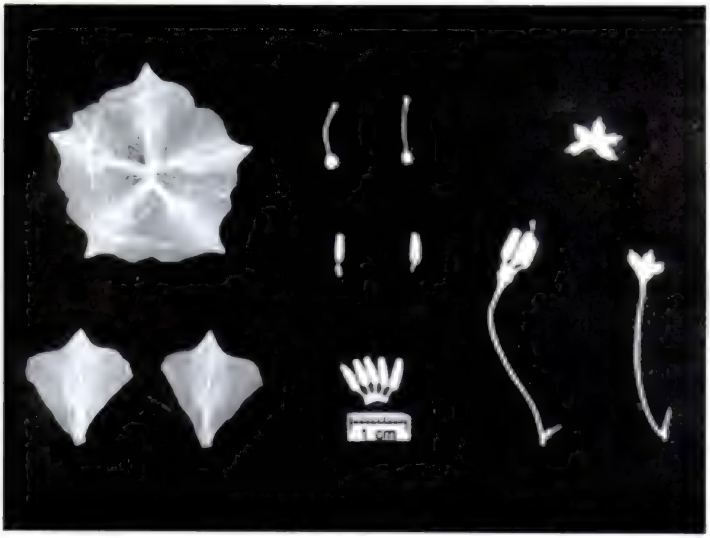


Figure 35. *Solanum chomatophilum.* Corolla rotate (*Ochoa 13845,* from Huamalíes, Huánuco).

material

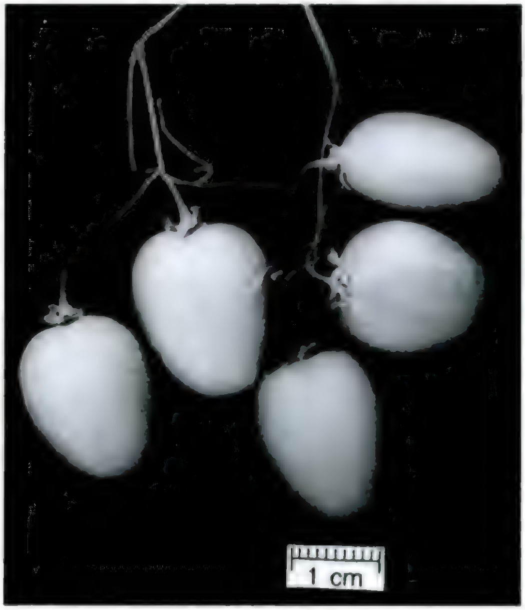


Figure 36. Fruits of *Solanum chomatophilum* (*Ochoa 13208*).

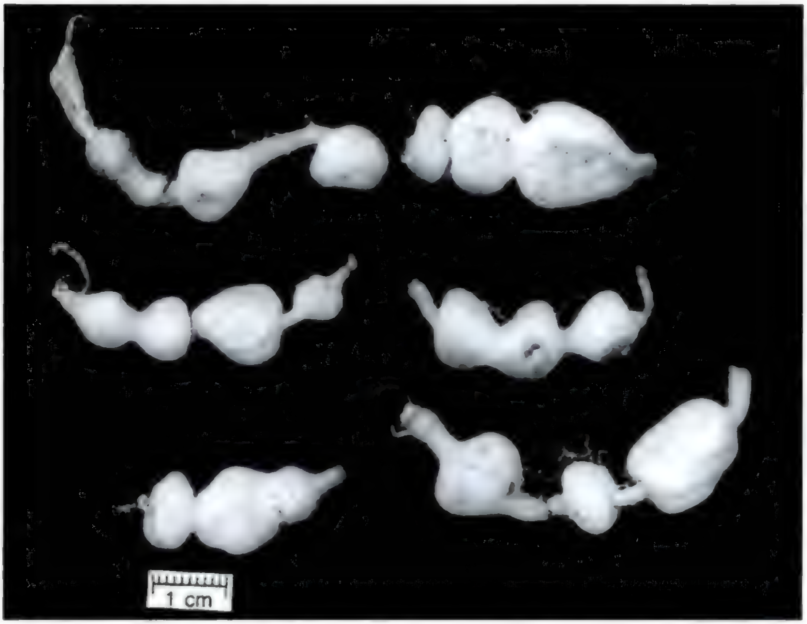


Figure 37. Tubers of *Solanum chomatophilum* (*Ochoa 10728*).

With respect to tuberization, the majority of the specimens that were examined in their original collection localities or in the experimental field under controlled conditions were lacking in both tubers and stolons. Only few plants were collected with tubers (e.g. *Ochoa 10728*, see Fig. 37), and then again these were quite small and either moniliform or submoniliform.

In collections coming from the Province of Azuay and in southern Cuenca, Ecuador, one comes across specimens of *S. tundalomense* (2n=72) that were growing in close association with *S. chomatophilum* (2n=24). Partly for that reason, therefore, it would appear that Correll's forma *angustifoliolum* of *S. chomatophilum* is but another duplicate name for *S. tundalomense* (*cf.* Wrightia 2:180, 1961). Similarly, while the author's collection No. *1436* from Ancash in northern Peru corresponds to the typical variety of *S. chomatophilum*, his collection No. *1795*, which was proposed as the type of *S. chomatophilum* f. *pilosum* Corr. (Wrightia 2:180, 1961), is actually a specimen of *S. piurae* (Ochoa, 1962).

Affinities

Solanum chomatophilum shares a number of characteristics in common with *S. nubicola*, including the shape of its leaves and leaflets, the position of its pedicel articulation as well as certain floral features. Other features of this plant, how-

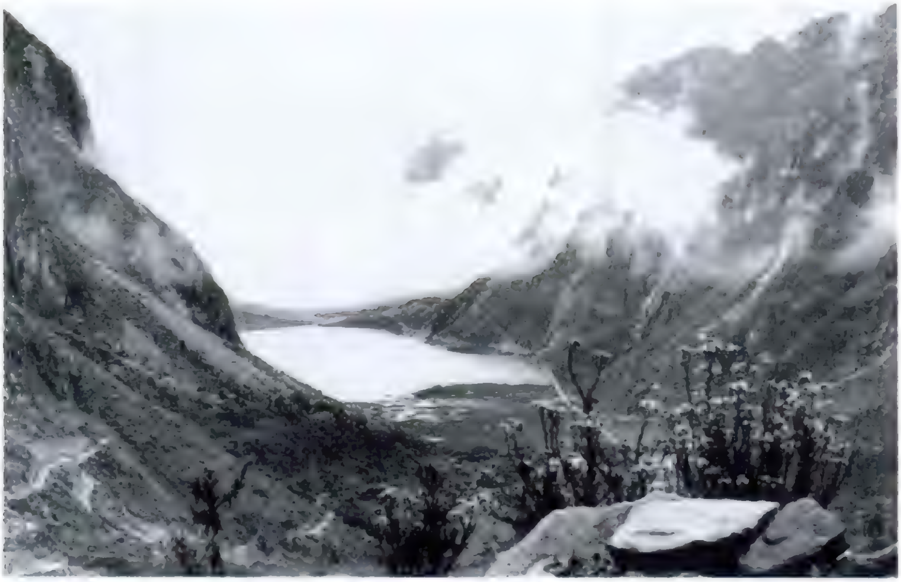


Figure 38. Habitats of *Solanum chomatophilum and S. ancophilum* near the small mountain lake of Llanganuco, Ancash.

ever, such as the elliptic shape of its glabrous leaflets and the size and fleshy consistency of its calyx, appear to be more in keeping with the species *S. huarochiriense*. The latter species differs from *S. chomatophilum* principally in having a higher pedicel articulation, finer-textured leaves and a globose instead of a long-conical berry.

Habitat and Distribution

This species grows essentially in the high *puna*, *jalca* or *paramo* formations of the mountains. It is not ruderal in the sense of being a plant closely associated with man, i.e. weedy. Although its altitudinal range varies from 1950 m to 4500 m, nearly 85% of the 280 collections studied in the present work were obtained from elevations between 3000 and 4500 m. The collection by D.N. Smith et al. (No. *10298*), made near the Nevado Pisco in the Huascarán National Park, records that the plant grew between 4600 m and 4800 m, but most likely the altitude was wrongly determined in this case.

Solanum chomatophilum is associated in the high mountain regions with grasslands of *Stipa ichu*, *Senecio*, *Plantago*, *Oxalis*, *Lupinus*, *Loasa*, *Cajophora*, *Ranunculus*, *Gentiana*, *Verbena*, *Rumex*, *Thalictrum*, *Gynoxis* and *Lobelia*, and relic stands of *Polylepis* and *Buddleja*. It also occasionally grows with other tuberous *Solanum* species such as *S. sogarandinum*, *S. jalcae*, *S. albicans* and *S. acaule*, or with such other non-tuberous species as *S. maturecalvans*.

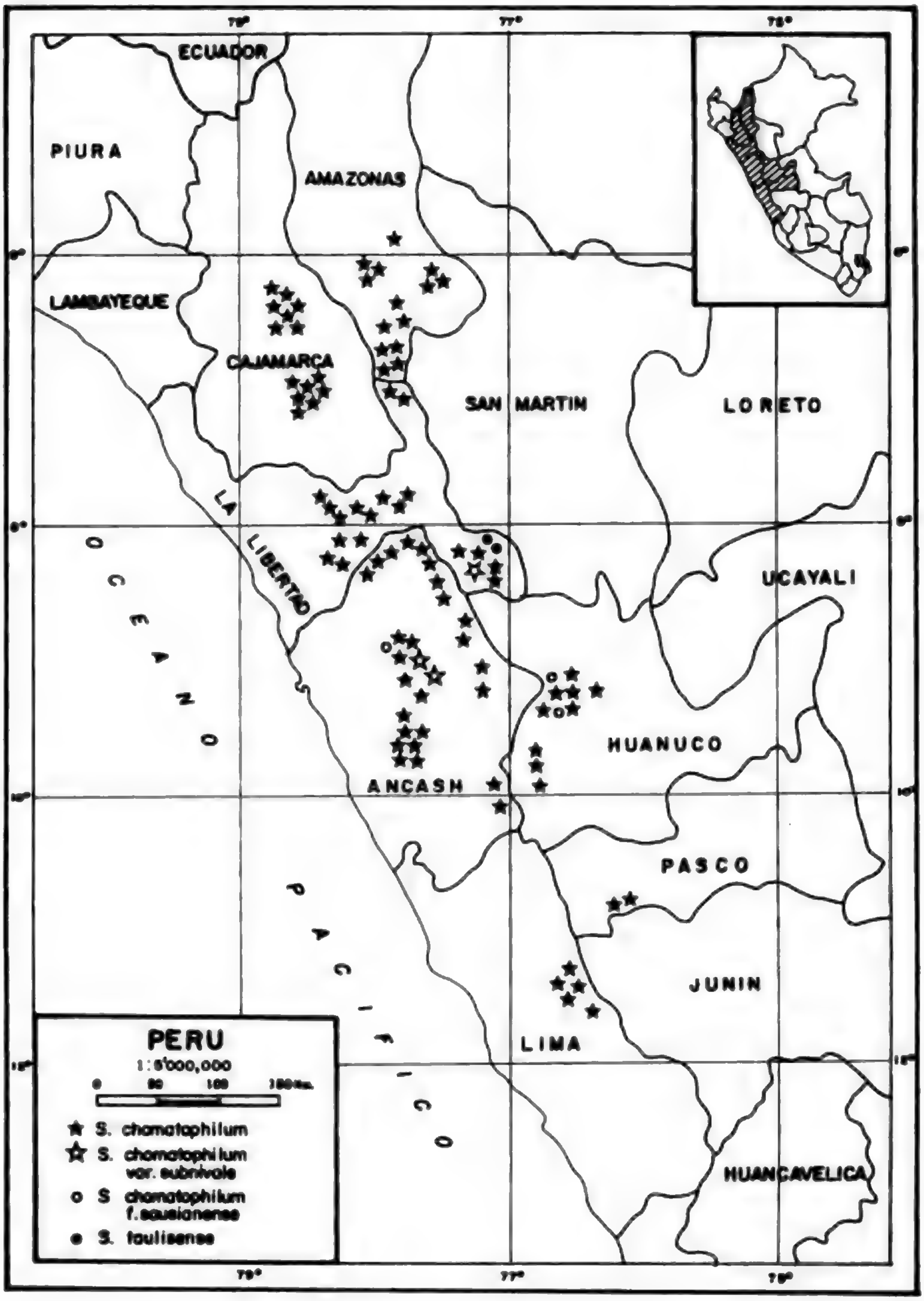
The extent and breadth of distribution of S. *chomatophilum* in Peru is exceeded only by *S. acaule* and *S. bukasovii*. Moreover, unlike the aforementioned species, this plant ranges northward to the Province of Azuay in southern Ecuador. In Peru, it is distributed from the Department of Lima in the central Andes north to the Department of Cajamarca, and northeastward to the Department of Amazonas. However, its greatest single center of concentration lies in the high mountain regions of the Departments of Pasco, Huánuco, La Libertad and Ancash (Map 8).

Specimens Examined

Department Amazonas

Province Bongara: El Totoral, distr. of Pomacochas, 2850 m alt., 4 April 1963, C. *Ochoa 2476* (GH, MO, MOL, OCH, US, USM).

Province Chachapoyas: Cerro Tinaja, 3000 m alt., 31 May 1952, C. *Ochoa.1664* (OCH). Cerro Coyupata, 3250 m alt., 4 April 1963, *C. Ochoa 2477* (GH, MOL, OCH, US, USM). Vicinity of Lluy, 3200 m alt., 5 April 1963, *C. Ochoa 2481* (OCH, from original plants) and *2481A* (OCH, from plants grown



Map 8. Distribution of *Solanum chomatophilum, S. chomatophilum* f. *sausianense, S. chomatophilum* var. *subnivale* and *S. taulisense.*

at Universidad Nacional Agraria, La Molina). Atuén, 3280 m alt., 6 April 1963, *C. Ochoa 2484* (OCH, US, from original plants) and *2484A* (OCH, from plants grown at Universidad Nacional Agraria, La Molina). Cordillera Calla-Calla, 3300 m alt., on stony hillsides, n.v. *Papita Silvestre,* flowers purple, June 1963, *A. López, A. Sagástegui and V. Collantes 4455* (OCH, HUT). Corral de la Virgen, near Pomacocha, *ca.* 3400 m alt. Along the road from Leymebamba to Calla-Calla pass, 14 May 1967, *C. Ochoa 2667* (F, GH, MOL, OCH, US). Below Calla Calla pass, towards Balsas, 3200 m alt., 15 May 1967, *C. Ochoa 2671* (F. GII, MOL, OCH, US). Palmahuayco, above Levanto, *ca.* 3100 m alt., 16 November 1974, *Z. Maycelo s.n.* (OCH). Near Convento, *ca.* 3000 m alt., distr. of Mayno, 25 March 1977, *C. Ochoa and Z. Maycelo 11753A,* 2n=24 (CIP, MOL, OCH, US, USM, from plants propagated at Huancayo). Ipaña, 3250 m alt., between Balsas and Leymebamba to the east of Calla Calla, in relic formations of evergreen cloud forest, plants herbaceous, tuber-bearing, flowers blue-purple, 21 December 1994, *I. Sánchez Vega and G. Bazán H. 7666* (OCH, UNIC)

Province Luya: Between Cutra Cuello and the village of Maria, 3200 m alt., 19 August 1976, *C. Ochoa 11061,* 2n=24 (CIP, F. GH, MO, MOL, NY, OCH, US) and (CIP, MO, MOL, OCH, USM, from plants grown in the greenhouse at Huancayo). Cutra Cuello, near Chontapampa, *ca.* 3200 m alt., between tall grasses, 31 March 1979, *C. Ochoa and Z. Maycelo 13244* (F. MOL, OCH).

Province Rodriguez de Mendoza: On the lower slopes of Cerro Queopcha, 3000-3300 m alt., along the road to Piscohuañuna, 10 May 1967, *C. Ochoa 2656* (OCH, US). Puca Ladrillo, 3300 m alt., along the Chachapoyas-Piscohuañuna road, leaves little divided, 10 May 1967, *C. Ochoa 2657* (OCH). Cerro Campanario, *ca.* 3700 m alt., 11 May 1967, *C. Ochoa 2661* (GH, MOL, OCH, US). Sauche, 3200 m alt., on the lower slopes of Cerro Campanario, 12 May 1967, *C. Ochoa 2662* (OCH). Cerro Canal, 3450 m alt., facing and toward the southern side of Cerro Campanario, 12 May *1967, C. Ochoa 2664* (OCH, US). Cerro Yana-Ladrillo, 3450 m alt., along the Chachapoyas-Piscohuañuna road, 12 May 1967, *C. Ochoa 2665* (CIP, GH, OCH, US).

Department Ancash

Province Aija: Along the road from Mallqui to Huarmán, 4000 m alt., near the right bank of the Cotaparia River, small plantlets were collected, 21 April 1983, *C. Ochoa and A. Salas 15151,* 2n=24 (CIP, GH, MOL, OCH, US, from plantlets grown at Huancayo).

Province Bolognesi: Near Chiquián, 3390-4000 m alt., in clay soil, flowers purple, 14 May 1950, *R. Ferreyra 7425* (MOL, OCH). Road to Huamanhueque east of Aquia, 3600 m alt., rigid mound in the crevices of rocks, n.v. *Papa del Gentil,* 14 May 1952, *E. Cerrate 1558* (OCH, USM).

Province Carhuaz: Huascarán National Park, Quebrada Ishinca (77°27' W, 9°23' S), 4100 m alt., forest of *Polylepis weberbauerii and Gynoxis,* flowers deep lavender, yellow anthers, in shade, 14 February 1985, *D.N. Smith, R. Valencia and A. Gonzáles 9570* (MO). Slope of Ulta, 4000 m alt., ascending by road from Carhuaz to Chacas, in a forest of *Polylepis* sp. trees with an understory of scruby herbs, *Lupinus, Loasa* and others, associated with *Solanum dolichocremastrum,* 5 April 1995, *C. Ochoa and A. Salas 16210* (CIP, MOL, OCH, USM). Ismurumi, 3600 m alt., above Cochas, within forests of aliso *(Alnus),* plants very young, without flowers, 5 April 1995, *C. Ochoa and A. Salas 16213* (CIP, OCH). District of Chacas, *Puna* de Paltajirca, 3900 m alt., south of Chacas past Cochas and Ismurumi, between tall grasses of *Stipa* sp., very scarce, 5 April 1995, *C. Ochoa and A. Salas 16214* (OCH). Slope of Ulta, 4100 m alt., along the road ascending from Ulta toward Punta Olímpica, associated with a non-tuberous *Solanum,* 5 April 1995, *C. Ochoa and A. Salas 16215* (CIP, MOL, OCH, USM).

Province Huaraz: Cerro Canchón, near Huanchay, *ca.* 3800 m alt., distr. of Pampas, plants 0.70 cm tall, on gravel slopes in tall grasses, June 1983, *J. Espejo Ruiz 008 p.p.* (OCH). Cerro Canchón, *ca.* 3800 m alt., distr. of Pampas, in crevices of rocks and between tall grasses, flowers deep sky-blue, 9 June 1983, *J. Espejo Ruiz 009* (OCH). Highlands of Huanchay, between 3400 and 3700 m alt., 7 June 1983, *C. Ochoa and J. Espejo Ruiz 15256* (OCH). Escalón, 3900 m alt., along the Huaraz-Casma road, vía Cayán Pass, between rocks, spiny shrubs and *Calceolarias,* tubers moniliform, tubers small 1.0-1.5 cm dia., white and round, 3 May 1984, *C. Ochoa 15732,* 2n=24 (CIP, F. GH, MO, MOL, OCH, US, USM) and (CIP, OCH, from plants grown in the greenhouse at Huancayo).

Province Huari: Highlands of San Luis, 4000 m alt., in very moist grassland, flowers blue, February 1960, *C. Ochoa 2276* (CIP, MO, MOL, OCH, US, USM). Near Chacas, 4000 m alt., flowers blue, plants 50 cm tall, February 1960, *C. Ochoa 2280* (MOL, OCH) and *2281* (OCH). Tashta, 4150 m alt., between Huari and San Luis, only small plantlets were collected, 16 April 1978, *C. Ochoa 12081,* 2n=24 (CIP, OCH, US). Huachococha, 4200-4400 m alt., between San Luis and Huari, collected only cropped plantlets without tubers, resistant to frost, 10 May 1978, *C. Ochoa 13012,* 2n=24 (CIP, F. GH, MOL, NY, OCH, US, from plants grown at Huancayo).

Province Huaylas: Huascarán, Quebrada Alpamayo at foot of snowfree peak above Lago Jancarurish (77°41' W, 8°53' S), 4350-4500 m alt., grassy slopes and bottoms on morainal material, flowers pale blue-purple, turning violet, among large boulders, old talus slope, 9 March 1985, *D.N. Smith, E. Valencia and A. Gonzáles 9770 p.p.* (MO). Huascarán National Park, between Huiscash and

Mirador (77°46' W, 8°53' S), 4350 m alt., *Polylepis weberbauerii* woods, on area of boulders, 12 March 1985, *D.N. Smith, R. Valencia and A. Gonzáles 10003* (MO).

Province Mariscal Luzuriaga: "Railroad line upward towards Tocana", distr. of F. Olivas, 3700 m alt., 13 May 1973, *Z. Huamán 485* (CIP). On high *jalcas* between Piscobamba and Sanashgan, 4000 m alt., many plants with abundant fruits, 7 May 1978, *C. Ochoa 13010*, 2n=24 (CIP, GH, MOL, OCH, US, USM).

Province Pallasca: Below the Huaura Mine, 3950 m alt., 23 April 1916, *A. Weberbauer 7201* (F two-sheets, GH two-sheets, US, type collection of *S. chomatophilum* Bitt.). Place below the Huaura Mine, 3640 m alt., 17 February 1961, *C. Ochoa and F. de la Puente 2344* (topotype OCH). Mines of Pasto Bueno, 3400 m alt., 17 February 1961, *C. Ochoa and F. de la Puente 2346* (OCH). Mines of Consuso, 3450 m alt., 17 February 1961, *C. Ochoa and F. de la Puente 2347* (OCH). Punas Combe, 3550 m alt., highlands of Cabana, 28 May 1963, *C. Ochoa 2523* (OCH). Acrana, 3500 m alt., berries long conical, May 1963, *Ochoa S-35,* 2n=24 (= *PI-365324,* herbarium and living collection at Sturgeon Bay, Wis., USA). Pahuas, 3600 m alt., near Conchucos, 4 June 1963, *C. Ochoa 2534* (OCH), *2534A* (OCH). Pushas-Pelagatos, 4000 m alt., on soils very rich in organic matter, 6 June 1963, *C. Ochoa 2538* (CIP, F. GH, MO, MOL, NY, OCH, US, USM). Mayo Grande, 3650 m alt., near the lagoon of the same name, amid stones and thickets, on the Conchucos-Chaquicocha road, 7 June 1963, *C. Ochoa 2541* (CIP, GH, MOL, OCH, US, USM). Acrana, 3700 m alt., between Conchucos and Chaquicocha, 8 June 1963, *C. Ochoa 2543* (CIP, GH, MOL, OCH, US). Lacabamba, 3800 m alt., on the Tambillos-Conchucos road, 9 June 1963, *C. Ochoa 2547* (MOL, OCH). Huaura Mine, 3500-3900 m alt., amid large rocks and grasses in very moist grassland, 10 June 1963, *C. Ochoa 2549* (topotypes CIP, GH, F, MOL, OCH, US, USM). Jalca de Conpajcha, 3700 m alt., southeast of Tamboras, 25 March 1964, *C. Ochoa 2557* (OCH). Below the highlands of Tamboras towards the mining seat of Consuso, grasslands, between 3500 and 3600 m alt., 25 March 1964, *C. Ochoa and J.G. Hawkes 2558* (OCH). Pasto Bueno, 3700-3850 m alt., near the Huaura Mine, in grassland, 26 March 1964, *C. Ochoa and J.G. Hawkes 2559* (OCH, US, topotypes of *S. chomatophilum* Bitt.). Cerro Huaura, 4000 m alt. (near San Luis), above the mines of Huaura, in *jalca* grasslands, 26 March 1964, *C. Ochoa and J.G. Hawkes 2560* (MOL, OCH, US, topotypes of S. *chomatophilum* Bitt.). Yungabal, 3500 m alt., near the seat of the Consuso Mine, 26 March 1964, *C. Ochoa and J.G. Hawkes 2562* (MOL, OCH, US). Vicinity of the mines of Huaura, 3800 m alt., adjoined mines of Consuso and Pasto Bueno, 7 February 1973, *C. Ochoa 3596* (MOL, OCH, topotypes of *S. chomatophilum* Bitt.).

Province Pomabamba: Contaderas, 3800 m alt., *jalcas* on the Sihuas and Pomabamba route, between stones, 2 June 1963, *C. Ochoa 2527* (CIP, GH, MOL, OCH, US, USM) and *2527A* (OCH). Acero Cruz, 3800 m alt., between Sihuas-Pomabamba, 1 km from Contadera, between stones, 2 June 1963, C. *Ochoa 2529* (MOL, OCH, USM).

Province Sihuas: Purguay, 3800 m alt., on the Sihuas-Conchucos road, between rocks, 3 April 1963, *C. Ochoa 2531* (CIP, F, GH, MO, MOL, NY, OCH, US, USM). Near Pariachuco, 3900 m alt., on the Sihuas-Conchucos road, 3 April 1963, *C. Ochoa 2532* (OCH). Wircacocha, 3900 m alt., ascending by road from Yuracc Marca to Sihuas, 3-6 May 1978, C. *Ochoa 13004,* 2n=24 (CIP, F, GH, MOL, NY, OCH, US).

Province Yungay: Huascarán National Park, Llanganuco sector, Quebrada Demanda, side valley to Nevado Pisco (77°37' W, 9°01' S), 4600-4800 m alt., flowers pale violet, in rocks, 13 April 1985, *D.N. Smith and Cautivo 10298* (MO). Quebrada Demanda, 4100 m alt. (77°36' W, 9°02' S), shrubland/grassland with small areas of *Polylepis* woods, N-facing steep slopes and bottoms, herb. in boulders, flowers pale violet, anthers yellow, in *Polylepis weberbauerii* woods, bottom, 12 April 1985, *D.N. Smith and V. Cautivo 10238* (USM, MO). Huascarán National Park, Quebrada Ranincuray (77°34' W, 8°59' S), 4100-4200 m alt., grasslands, mostly on steep slopes, heavily overgrazed, herb., flowers pale violet, growing in rocks under shrubs, l8 April 1985, *D.N. Smith, R. Valencia and A. Gonzáles 10439* (MO, UNTC). Huascarán National Park, Quebrada Ranincuray (77°34' W, 8°59'S), 3700 m alt., talus slopes, S-facing, steep, lithophytic herb, erect, roots have tubers, foliage has violet cast especially below, flowers pale violet, 19 April 1985, *D.N. Smith, R. Valencia and A. Gonzáles 10484* (MO, UNTC).

Department Cajamarca

Province Bambamarca: Tambillo near Bambamarca, 18 February 1979, *C. Ochoa 13207,* 2n=24 (CIP, GH, OCH, US, from plants grown at Huancayo).

Province Cajamarca: Atokk Saicu, *jalcas* of the Hacienda Porcón, 3500 m alt., 21 May 1952, *C. Ochoa 1510* and *1511* (OCH). On slope about 43 km from Cajamarca on road to Chilete, 1950 m alt., 24 March 1960, *D.S. Correll and E.E. Smith P840* (LL). Hacienda Porcón, about 1 km from entrance, 3500 m alt., plants with long stolons, flowers purple, rotate, fruits ovoid-cordate, green, up to 3.5 cm long, 25 March 1960, *D.S. Correll and E.E. Smith P862*, (K, LL 2 sheets, MO, NY, US, US, USM). Hacienda Porcón, mountains near entrance, 3550 m alt., north of Cajamarca, rocky grassy open slopes, flowers deep lavender, 25 March 1960, *D.S. Correll and E.E. Smith P868* atípico, leaves very dissected (LL). *Jalcas* of the Hacienda Porcón, 3400 m alt., 2 April 1960, *C. Ochoa 2290*

(OCH, US, from plants grown at the Universidad Nacional Agraria La Molina, Lima). 28 km NW of Cajamarca, 3260 m alt., on road to Pedernal and 12 km W from this point to Hacienda Granja Porcón, growing on steep banks of small stream with *Solanum chiquidenum* var. *porconense*, *S. chomatophilum*, *Calceolaria*, *Brassica*, *Epiloblum*, *Trifolium*, *Rumex*, *Erodium*, *Lupinus*, *Equisetum*, *Veronica*, *Thalictrum*, *Lepidium*, *Stipa ichu*, *and* non-tuberous *Solanum* sp., 6 June 1963, *D. and V. Ugent 5416, 5418, 5425, 5428, 5429-30, 5431,* 5434, *5435,* 5438, *5441, 5442,;5443, 5444,* and *5447* (all in WIS); *5437* (OCH); *5439* (F); *5449* (GH). 28 km NW of Cajamarca, on road to Pedernal and 12 km W from this point to Hacienda Granja Porcón, *3260* m alt., growing on steep banks of small stream with *Solanum chiquidenum* var. *porconense*, *S. chomatophilum*, *Calceolaria*, *Brassica*, *Epilobium*, *Trifolium*, *Rumex*, *Erodium*, *Lupinus*, *Equisetum*, *Veronica*, *Thalictrum*, *Lepidium*, *Stipa ichu*, and non-tuberous *Solanum* sp., 6 June 1963, *D. and V. Ugent 5417, 5424 and 5427* (WIS). Surroundings of the main building of Hacienda Porcón, *3350* m alt., 29 March 1964, *C. Ochoa 2565* (OCH). Encañada, *3620* m alt., km *60* Cajamarca-Celendín, on right hand side of road, by a small farm, 5 August 1974, *M. Jackson and Anaya s.n.* (CIP). Distr. of Cumbe Mayo, *jalcas* of the Cuesta del Cumbe, *3400* m alt., between large rocks and tufts of *Stipa,* plants vigorous, well formed with abundant fruit, leaves atypical, long and narrow very dissected with up to 8 pairs of leaflets and up to 8 pairs of interjected leaflets, berries long-conical, April 1976, *C. Ochoa 10728, 2n=24* (CIP, F, GH, MOL, OCH, UNTC, USM, US). Cerro Chontayo, between San Juan and Sunchubamba, *3600* m alt., April 1978, *C. Ochoa and A. Salas 12538*, 2n=24 (CIP, MOL, OCH, USM). Between km 40 and 41, 3200 m alt., on the Cajamarca-Hualgayoc road, in grassland, April 1978, *C. Ochoa and Salas 12562* (CIP, OCH). At 60 of the Cajamarca-Hualgayoc road, 3500 m alt., April 1978, *C. Ochoa and A. Salas 12563* (CIP, OCH). Near km 70 of the Cajamarca-Hualgayoc road, 3500 m alt., April 1978, *C. Ochoa and A. Salas 12564* (CIP, OCH). Between Tablacucho and Encañada, 3600 m alt., on the Cajamarca-Celendín road, 19 February 1979, *C. Ochoa 13210*, 2n=24 (CIP, OCH). Jalca of Silleropata, 3600 m alt., near Coimolache on the road to Celendín, very scarce, plants semi-rosette forming, 19 February 1979, *C. Ochoa 13212*, 2n=24 (OCH). Pampa de la Encañada, 3100 m alt., a few km beyond La Encañada, on the road to Celendin, only plantlets were collected, 27 November 1981, *C. Ochoa 14496*, 2n=24 (OCH, from plants grown in the greenhouse at Huancayo). Between Cajamarca and Cumbe Mayo, 3200 m alt., herb with small tubers, 4 June 1971, *I. Sánchez Vega, W. Ruis Vigo and M. Vilhena R. 736* (UNTC). Abra El Gavilán, 3100-3150 m alt., between Cajamarca and San Juan, in *jalca* grasslands, perennial, flowers purple, 23 March 1985, *I. Sánchez Vega and U. Molau 3714* (UNTC). Uchuquinua, 3600 m alt., in *jalcas* along the Chota-San Miguel road detour, 27 March 1987, *C. Ochoa and A. Salas 15996*, 2n=24 (CIP, MO, MOL, OCH, US, USM). *Jalcas* of China Linda, 3600 m alt., on the Cajamarca-Chota road, March 1987, *C. Ochoa and A. Salas 15997* (CIP, OCH). Huaguin, towards the west and near Porcón, 3200 m alt., 29 March 1992, *C. Ochoa and A. Salas 16003* (CIP, MOL, OCH), *16004*, 2n=24 (CIP, OCH), and *16005* (CIP, OCH). Pozo Seco, 3400 m alt., between Porcón and the mountains of Atokk Saicu and Cerro Molino, distr. San Pablo, flowers very dark purple, 29 March 1992, *C. Ochoa and A. Salas 16007* (CIP, MOL, OCH). Cerro Campanario, descending to Atokk Saicu and Cajamarca, 3500 m alt., stem sparsely pilose, 29 March 1992, *C. Ochoa 16012* (CIP, OCH) and *16013* (CIP, OCH). Cerro Campanario, descending to Atokk Saicu and Cajamarca, 3500 m alt., 29 March 1992, *C. Ochoa and A. Salas 16014* (CIP, OCH, USM) and *16015* (CIP, OCH, US, USM). Rollopampa, lower slopes of Cerro Campanario, 3440 m alt., 29 March 1992, *C. Ochoa and A. Salas 16016* (CIP, MOL, OCH) and *16017* (CIP, OCH, USM). Pululo, 3500 m alt.,on Cerro Cristal, between Porcón and San Pablo, 29 March 1992, *C. Ochoa and A. Salas 16019* (CIP, OCH) and *16020* (CIP, MOL, GH, OCH, US, USM). Huaca Rumi, 3680 m alt., near Incahuasi, detour path at km 49 of the Cajamarca-Hualgayoc road, in grasslands and between large rocks with red-flowered *Cajophora* sp., 1 April 1992, *C. Ochoa and A. Salas 16040* (CIP, MOL, OCH, US, USM), *16041* (CIP, MOL, OCH, US, USM) and *16042* (CIP, MOL, OCH). Sixsimayo, 3500 m alt., on the Cajamarca-Cumbemayo road, 2 April 1992, *C. Ochoa and A. Salas 16051* (CIP, OCH). Sinsi, 3650 m alt., at km 25 along the border of the Cajamarca-Hualgayoc road, between tufts of *Stipa* sp., 2 April 1992, *C. Ochoa and A. Salas 16059* atípico, leaves very dissected (CIP, MOL, OCH), *16060* atípico, leaves very dissected (CIP, OCH), and *16061* atípico (CIP, OCH, USM). Porcón, 3200 m alt., 28 April 1992, *C. Ochoa and A. Salas 16070* (CIP, MOL, OCH, USM) and *16071*, 2n=24 (CIP, OCH, USM, from plants grown in the greenhouse at Huancayo), *16072* (CIP,OCH), *16073* (CIP, OCH, from plants propagated at Huancayo), *16074* (CIP, OCH), *16075* (CIP, MOL, OCH, USM, from plants propagated in the greenhouse at Huancayo) and *16076* (CIP, OCH).

Province Celendin: *Jalca* near km 60 on the Cajamarca-Celendín road, 3500 m alt., plants rosette-like at base, tall (50 cm) or small (20 cm), the last entirely rosette forming, without stems, without tubers, 20 May 1952, *C. Ochoa 1517* (GH, OCH) and *1518* (OCH). Cruz Conga, 3700-3800 m alt., within the *jalcas* of Cumulca and Celendín, between low-mountain relic stands, flowers purple, 6 August 1958, *R. Ferreyra 13275* (OCH, USM). Condomarca, 2950 m alt., on the Cajamarca-Celendín road, 1 March 1961, *C. Ochoa and F. de la Puente 2351* (OCH). Between Cerro Huanco and Santa Rosa, 3000 m alt., at 10 km south of Sucre, March 1971, *C. Ochoa 2957* (OCH). Grasslands between Cumulca Pass and Celendín, 3300 m alt., 28 February 1973, *C. Ochoa 3605* (F, GH, MO, MOL, NY, OCH, US, USM). On the middle slopes of Cerro Curape, 2320 m alt., facing Utco, crossing Lucmapampa towards the east, growing on calcareous land with abundant moist remains of more than 0.5 m in thickness, protected by shrubs of *Rubus,* small calceolárias and abundant *Datura,* in a warm valley with dry climate, the potato plants are generally small, with fine leaves, plants very scarce, fruits round, 28 March 1988, *C. Ochoa and A. Salas 12553* (OCH). Piedra Grande, 2900 m alt., on the road to Sorochuco, April 1978, *C. Ochoa and A. Salas 12560,* 2n=24 (CIP, MOL, OCH, US, USM), and *12561* (CIP, MO, MOL, GH, OCH, US, USM). Tablacucho, 2900 m alt., near Sorochuco, 18 February 1979, *C. Ochoa 13208,* 2n=24 (CIP, F, GH, MOL, US).

Province Chota: Coñorpata, 3000 m alt., Cuyumalca ranch, near Chota, plants semi-rosette forming, 23 May 1952, *C. Ochoa 1531* (MOL, OCH). Cerro Iris, near Chota, 3000 m alt., amid abundant hedge herbs and shrubs, 30 April 1972, *C. Ochoa 3304* (OCH). Cerro Huahuina, distr. Tacabamba, only plantlets were collected, 13-16 February 1979, *C. Ochoa 13203, 13204 and 13205,* 2n=24 (CIP, F, GH, OCH, US, from plants grown at Huancayo). Highlands of Huasipata, 2800 m alt., near Tacabamba, 16 February 1979, *C. Ochoa 13206,* 2n=24 (CIP, OCH, from plants grown at Huancayo). Lingán, 3200 m alt., near Chota, plantlets were collected, 19 February 1979, *C. Ochoa 13213,* 2n=24 (CIP, GH, OCH, US, from plants grown in the greenhouse at Huancayo).

Province Hualgayoc: Near Hualgayoc, 3300 m alt., April 1978, *C. Ochoa and A. Salas 12565,* 2n=24 (CIP, OCH, USM). Tingo, 3200 m alt., along the road to Chugur, April 1978, *C. Ochoa and A. Salas 12567* (CIP, MO, GH, MOL, OCH, US, USM). Near the Carolina Mine, 3500 m alt., above Chugur in the unilateral ion of Cajamarca, April 1978, *C. Ochoa and A. Salas 12570,* 2n=24 (CIP, OCH, USM). Near the Predilecta Mine, 3700 m alt., distr. of Hualgayoc, 8 February 1979, *C. Ochoa 13196,* 2n=24 (CIP, MOL, OCH). Quinuapampa, 3600 m alt., distr. of Hualgayoc, 8 February 1979, *C. Ochoa 13198,* 2n=24 (CIP, OCH, US). *Jalcas* of Quinuapampa, *ca.* 3450-3500 m alt., 8 February 1979, *C. Ochoa 13199,* 2n=24 (CIP, OCH), *13200,* 2n=24 (OCH), and *13201,* 2n=24 (CIP, GH, OCH, US). Cerro Lorromó, 3650 m alt., distr. Hualgayoc, 13 February 1979, *C. Ochoa 13202,* 2n=24 (CIP, GH, MOL, OCH, US, USM). *Jalca* of Shoglla, 3800 m alt., on the Cajamarca-Hualgayoc road, February 1982, *C. Ochoa 14521,* 2n=24 (CIP, OCH). *Jalca* of Ccolccerumi, 4000 m alt., 5 km before Hualgayoc on the Hualgayoc-Bambamarca road, February 1982, *C. Ochoa 14522* (OCH). *Jalcas* of Jalampa, 3800 m alt., between Cajamarca and Hualgayoc, 3800 m alt., scarce, 22 April 1983, *C. Ochoa 14786,* 2n=24 (CIP, NY, MOL, OCH, US, USM). *Jalcas* of Shojlla, on the Cajamarca-Hualgayoc road, 3800-4000 m alt., 20 May 1982, *C. Ochoa 14787* (NY, OCH, US) and *14788,* 2n=24 (CIP, NY, OCH, US, WIS). Surroundings of the Predilecta Mine, 3750 m alt., near Hualgayoc, 20 May 1982, C. *Ochoa 14790* (OCH). Quinuabamba, 3700 m alt., near Hualgayoc, 20 May 1982, C. *Ochoa 14791* (OCH). Huahuina, distr. Hualgayoc, 3700 m alt., 20 May 1982, C. *Ochoa 14792* (CIP, OCH, US). Lorromó, 3700 m alt., 20 May 1982, C. *Ochoa 14793* (OCH). Cerro Calvario, distr. Hualgayoc, 3600 m alt., 20 May 1982, C. *Ochoa 14794* (CIP, OCH). Lower slopes of Cerro Calvario, 3400-3500 m alt., distr. Hualgayoc, 20 May 1982, C. *Ochoa 14795* (CIP, MOL, OCH, US, USM). Huasipata, *ca.* 3450 m alt., 20 May 1982, C. *Ochoa 14796* (OCH). Tablacucho, *ca.* 3350 m alt., 20 May 1982, C. *Ochoa 14797* (CIP, F, GH, MOL, NY, OCH, US). *Jalcas* between Shojlla and Hualgayoc, only two ripe berries that had fallen to the ground were collected, 5 June 1983, C. *Ochoa 15257*, 2n=24 (CIP, OCH, from plants grown at La Molina, Lima), and *15258*, 2n=24 (CIP, OCH, from plants grown in the greenhouse at Huancayo). Above Culquirrumi, 3150 m alt., km 21 of the Bambamarca-Cajamarca road, between forest shrubs and herbs, flowers purple, 26 March 1985, *I. Sánchez Vega, U. Molau and L. Ohman 3792* (UNTC).

Department Huánuco

Province Dos de Mayo: Baños [Prov. Dos de Mayo, Dept. Huánuco], Peru [without date], Expedition of Captain *Wilkes s.n.* (NY, US).

Province Huamalies: Near the gorge of Angel Cocha, 4000 m alt., between Tantamayo and Jircán, 26 April 1967, C. *Ochoa 2643* (OCH) and *2644* (OCH, MOL, USM). Portachuelo, 3450 m alt., between Huanca and Chequias, 27 April 1967, C. *Ochoa 2647* (MOL, OCH). Near Japallán, 3580 m alt., on the road to the base of the *jalcas* of Lagma, from Carpa to Japallán, n.v. Papa de *Zorro,* 25 March 1976, C. *Ochoa 10906* (OCH). Lower slopes of Cerro Huiro or Huiro Huiro, 3400 m alt., on the CarpaTantamayo road, Distr. Tantamayo, 25 March 1976, C. *Ochoa 10907* (CIP, OCH). Between Jircán and Laguna Carpa, 3550 m alt., Distr. Jircán, within dense grassland with tufts of *Stipa* sp. to more than 1 m tall, 27 March 1976, C. *Ochoa 10908* (CIP, OCH). Between Jircán and Urpish, 3450 m alt., Distr. Jircán, 27 March 1976, C. *Ochoa 10909* (CIP, OCH). Quebrada de Chequias, near Chequias, 3350 m alt., Distr. Arancay, 28 March 1976, C. *Ochoa 10910* (OCH). Near the bank of the lagoon of Angel Cocha, eastern side, 3680 m alt., Distr. Tantamayo, 29 March 1976, C. *Ochoa 10911* (OCH). Between Carpa and Tantamayo, 3600 m alt., in grasslands, flowers violet, tubers strongly infected with *Synchytrium endobioticum,* 15 April 1980, C. *Ochoa 13844* (CIP, GH, OCH, MOL, US, USM). Vicinity of Jircán, 3000 m alt., between Notgay and Jircán, leaves vernicose, 15 April 1980, C. *Ochoa 13845* (CIP, GH, OCH, US) and *13845* (CIP, OCH, from plants grown in the field at Huancayo). On the Tantamayo-Urpish road, 3500 m alt., April 1968, C. *Ochoa* S-76, 2n=24 (OCH, from plants grown at Sturgeon Bay, Wis., USA).

Province Huánuco: Inca Cocha, 3250 m alt., near the left bank of the Radio Yacu River, amid stone walls and many thickets, 7 April 1976, C. *Ochoa 11050* (OCH). Punta Cuerno, *ca.* 4000 m alt., near the highest railroad pass, between Tambogán and Papahuasi, heading downwards toward Papahuasi, tubers very small, less than 10 mm in dia., 7 April 1976, C. *Ochoa 11051* (OCH). Papahuasi, near the banks of the Huayrana River, *ca.* 3500 m alt., in grasslands, 7 April 1976, C. *Ochoa 11052* (OCH). Punta Llaulli, 3800 m alt., Tambogán, near Pezer on the footpath to Inca Cocha, in the hollows of rocky prominences, associated with *Stipa ichu*, 8 April 1976, C. *Ochoa 11055* (MOL, OCH).

Province Pachitea: Near Tambo de Vaca, *ca.* 3600 m alt., amid woody shrubs, abundant, 20 May 1984, C. *Ochoa and A. Salas 15769A* (CIP, GH, MO, MOL, OCH, US, USM).

Department La Libertad

Province Bolívar: La Quinua, 3200 m alt., between Longotea and Bolívar, 28 February 1961, C. *Ochoa and F. de la Puente 2349* (OCH). Between Uchumarca and Bolívar, 3100 m alt., 10 February 1973, C. *Ochoa 3597* (GH, F, OCH, US).

Province Otuzco: Above the ranch house of Hacienda Motil, 3100-3300 m alt., 12 May 1952, C. *Ochoa 1436* (GH, OCH, US), *1437* and *1438* (OCH). *Jalcas* of Muchucaira, 4100 m alt., about 10 km from Carnpero, between Hacienda Motil and Santiago de Chuco, 21 May 1963, C. *Ochoa 2503* (T, GH, OCH, US). Vicinity of the San Lorenzo lagoon, 3900 m alt., amid large stones and hollows, in moist soil, associated with *hortigas*, ferns, ichu-type grasses, April 1978, C. *Ochoa 12535* (OCH). Cerro Sango, 3900 m alt., before Quiruvilca, growing with *Solanum jalcae*, 9 May 1979, C. *Ochoa 13343*, 2n=24 (CIP, F, GH, OCH, US). Cerro Sango, 3450 m alt., between Motil and Shorey, under rocks covered with *Bromelias,* were collected stringy plants with long-conical ripe berries, dark-green, 7 July 1981, C. *Ochoa 14484,* 2n=24 (CIP, OCH, US, from plants grown at Huancayo). Cerro Sango, lower part, 3400 m alt., amid large colonies of "Ttola" or *Lepidophyllum cuadrangulare,* within the entire habitat of the *jalca*, abundant fruit, tubers not found, foliage greatly infected with *Puccinia pittieriana,* 7 July 1981, C. *Ochoa and A. Salas 14485* (OCH). Cerro Sango, 3450 m alt., between Motil and Shorey, only ripe long-conical berries were collected, 7 July 1981, C. *Ochoa and A. Salas 14486*, 2n=24 (CIP, GH, OCH, US, from plants grown at Huancayo).

Province Pataz: Paso de Alaska, 3400 m alt., between Retamas and La Paccha, *puna* on moist hilleside, n.v. *Chaucha de Zorro,* flowers purple, 20 May 1961, *A. López and A. Sagástegui 3400* (GH, HUT, OCH). Between Retamas and Paso de Alaska, 3800 m alt., amid stones, 18 June 1971, *C. Ochoa 3020* (OCH). Cueva Negra, near Tuco, 3800 m alt., between Tayabamba and Huancaspata, in black very moist soil, 21 June 1971, *C. Ochoa 3024A* (OCH). Vicinity of the Culluna lagoon, 3850 m alt., leaves with broadly lanceolate sharp-pointed leaflets, sessile, 22 June 1971, *C. Ochoa 3028* (GH, MOL, OCH, US). Gueishgue or Huesgue, 3350 m alt., above Huarimarca, on very moist shrubby slopes with abundant grasses, 15 February 1973, *C. Ochoa 3600* (OCH). Huagcha, 3600 m alt., above Huarimarca, amid dense thicket-shrubs and herbs, 25 February 1973, *C. Ochoa 3601* (OCH). Between Huancaspata and Tayabamba, 3800 m alt., roadside, in stony soil, tuberous herb with purple flowers, 27 June 1974, *A. López and A. Sagástegui 8250* (GH, HUT, OCH). Between Paso de Alaska and Huiro-Huiro, 3700 m alt., on the Parcoy-Tayabamba road, amid *Budleja, Polylepis* and *Stipa* sp., 2 May 1979, *C. Ochoa 13307*, 2n=24 (CIP, F, GH, MOL, OCH, US). Cueva Negra, 3775 m alt., on the Tayabamba-Huancaspata road, berries long-conical, 5 May 1979, *C. Ochoa 13309*, 2n=24 (CIP, GH, MOL, OCH, US). Ranra-Ranra, 3700 m alt., between Tayabamba and Huancaspata, between tall grasses and hedgerows of *Barnadesia* sp. and *Calceolaria* sp. with abundant tussocks of *Stipa* sp., berries long-conical, 6 May 1979, *C. Ochoa 13319,* 2n=24 (CIP, OCH, from plants grown at Huancayo). *Jalcas*, between highlands of Tayabamba on the horsepath to Urpay, 3700 m alt., plants small, 30 cm tall, berries long-conical, 7 May 1979, *C. Ochoa 13325*, 2n=24 (CIP, GH, MOL, OCH, US, from the original plants) and (CIP, MOL, OCH, from plants grown in the greenhouse at Huancayo). Near Tauli, 3900 m alt., amid *jalca* grasses and between shrubs, 7 May 1979, C *Ochaa 13332*, 2n=24 (OCH). *Jalcas* at Tauli, 3800-3900 m alt., amid tall stems in dense grasslands or between melastomes and *Polylepis* shrubs, growing between hedge herbs of *Oxalis* sp. and ferns, 7 May 1979, *C. Ochoa 13333*, 2n=24 (OCH, original collection; and CIP, MOL, OCH, US, USM, from plants grown in the field at Huancayo). Between Huarimarca and Palo Seco-Huarimarca, *comprensión de Tayabamba*, *ca.* 3500 m alt., 7 May 1979, *C. Ochoa 13337*, 2n=24 (OCH). *Jalcas* between Huarichaca and Tauli, *ca.* 3700 m alt., in grassland, only berries were collected, May 1979, *C. Ochoa 13339*, 2n=24 (CIP, OCH, from plants grown in the greenhouse at Huancayo). Highlands of Huallamarca, 3580 m alt., in *jalcas* along the road from Huaguil to Pallar, between rushes in very moist marshland at the base of a slope, 8 May 1979, *C. Ochoa 13341*, 2n=24 (CIP, F, GH, MOL, OCH, US).

Province Sánchez Carrión: *Jalcas* of Tallanga, 3600 m alt., near Huamachuco, 14 April 1959, *C. Ochoa 2166* (OCH, US). Between Huaylillas Pass and the highlands of Tamboras, 3850 m alt., in *jalca* grassland, abundant, 25 March 1964, *C. Ochoa and J.G. Hawkes 2554* (OCH). *Jalcas* of Compajcha, 3700 m alt., to the southwest of Tamboras, in grassland, 25 March 1964, *C. Ochoa and J. G. Hawkes 2555* (OCH). Km 19.5 from Yamobamba towards Huaylillas, 4200 m alt., 21 May 1973, *Z. Huamán 647* (CIP, OCH). Pampa del Cóndor, *ca.* 3500 m alt. On the Trujillo-Huamachuco road, 10 March 1977, *C. Ochoa 11601* (OCH) and *11755*, 2n=24, only mature berries were collected (CIP, GH, MOL, NY, OCH, US, from plants grown at Huancayo). Peña Negra, 3350-3400 m alt., near Los Quinuales, associated with *Alonsoa, Bidens, Calceolaria* and various species of composites, 1 May 1979, *C. Ochoa 13288*, 2n=24 (OCH). About 7 km west of Huaguil, 3550 m alt., on steep mountain slopes and within *jalca* grassland with some isolated plants of *Solanum sogarandinum*, 1 May 1979, *C. Ochoa 13292* (CIP, MOL, OCH, US).

Province Santiago de Chuco: Huaylillas, north of Cachicadán, 4000 m alt., corolla uniformly purple, stamens yellow, 26 November 1938, *H.E. Stork and O.B. Horton 10006* (F). Coipin, 3800 m alt., *jalca* along the Shorey-Santiago de Chuco road, 14 May 1952, *C. Ochoa 1439* (OCH). Between Sogaranda and Sauca, 3700 m alt., 21 May 1963, *C. Ochoa 2504* (CIP, GH, OCH, US). Mumpamba, 3200 m alt., near Cachicadán, berries long-conical, 23 May 1963, *C. Ochoa 2509* (CIP, GH, OCH, MOL, NY, US) and *2509a* (OCH, from plants grown at Universidad Nacional Agraria La Molina). Compajcha, 3700 m alt., near and to the southwest of Tamboras, 25 March 1964, *C. Ochoa and J.G. Hawkes 2556* (MOL, OCH). Vicinity of Cachicadán, 3000 m alt., only mature berries were collected, 17 November 1971, *C. Ochoa 3041*, 2n=24 (OCH, from plants grown at the Universidad Nacional Agraria La Molina, Lima). Imbal, 3250 m alt., between Cachicadán and Las Combas, on the Cachicadán-Angasmarca road, 6 May 1972, *C. Ochoa 3320* (CIP, OCH, US).

Department Lima

Province Canta: Cerro Colorado, 3800-4000 m alt., near Antaicocha, east of Canta, rocky slopes and bushy thickets, lax or climbing herb, corolla dark bluish violet, 20 June 1925, *F.W. Pennell 14651* (F, GH, NY); *14656* (F). Cerro Quinán, 4000 m alt., *punas* at Lachaqui, rocky moist foothill, flowers violet, 30 June 1972, G. *Vilcapoma* S. 66 (USM).

Department Pasco

Province Pasco: Between km 30 and 40 of the Paucartambo-Carhuamayo road, beyond the village of La Victoria, 3500-3600 m alt., in *puna*, flowers bluish-purple, tubers 3 cm long, ovoid, 15 March 1951, *C. Ochoa 1016* (LE, OCH, topotype of S. *pascoense* Ochoa). Near La Victoria, on the road from

Carhuamayo to Paucartambo, 3500-3600 m alt., in *puna,* 15 March 1951, *C. Ochoa 1027* (OCH, type collection of S. *pascoense* Ochoa). Lower foothills of Cerro Huishca, 3500 m alt., in *puna*, about 15 km before Paucartambo, on the Carhuamayo-Paucartambo road, in full flower and fruit, 21 March 1968, *C. Ochoa 2679* (MOL, OCH, USM). Acopalca, 3300 m alt., between La Victoria and Paucartambo, Distr. Paucartambo, 28 January 1978, C. *Ochoa 11856*, 2n=24 (CIP, MOL, OCH, US, from the original plants), and *11856* (CIP, OCH, from plants grown in the greenhouse at Huancayo). La Victoria, 3700 m alt., in *puna*, on the Paucartambo-Carhuamayo road, berries ovoid, 28 January 1978, C. *Ochoa 11858*, 2n=24 (CIP, GH, MOL, OCH, US). 2 km before La Victoria, *ca.* 3600 m alt., on the Carhuamayo-Paucartambo road, very scarce, only fragments, 1 May 1983, C. *Ochoa 15195*, 2n=24 (OCH). *Puna* between La Victoria and Paucartambo, 3500 m alt., very scarce, 4 January-10 February 1984, C. *Ochoa 15302*, 2n=24 (OCH).

Department San Martin

Province Mariscal Cáceres: Puerta del Monte, 3550 m alt., Río Abiseo National Park (approximately 7°S, 77° W), in high elevation grassland, outside of forest patch, "P-1" montano rain forest, purple petals, 19 November 1985, *Ken Young 1661* (MO, USM). Above timberline, Puerta del Monte, 3330 m alt., Río Abiseo National Park (approximately 7°S, 77° W), herb, has root tubers, n.v. *Papa de Gentil,* forest patch (P-12), mountain rain forest, 22 November 1985, *Ken Young 2059* (MO, USM).

ECUADOR

Province Azuay: In paramos in the vicinity of El Portete, 3000 m alt., south of Tarqui, May 1976, C. *Ochoa 11048 (CIP,* OCH). Near El Portete, 3000 m alt., October 1976, C. *Ochoa 11276*, 2n=24 (CIP, OCH).

Natural Hybrids of *Solanum chomatophilum*

Two totally atypical collections of *S. chomatophilum* are known from northern Peru. Morphologically, the plants appear to be of the following hybrid origin:

Solanum chomatophilum × *S. jalcae?*

Plants small to medium size with leaves having 3(-4) pairs of leaflets and 0-2 pairs of interjected leaflets; leaflets narrowly oblanceolate, sessile, narrowly decurrent about the rachis; the base of the terminal leaflet conspicuously long cuneate and decurrent about the petiolule. Inflorescence cymose, pedicels 30-40 mm long, articulation high, about 5 mm below the base of the calyx. Corolla dark blue-violet, rotate.

Department La Libertad

Province Otuzco: In *jalca*, vicinity of the San Lorenzo lagoon, 3900 m alt., in moist soil, among stones and hollows, in grassland, associated with ferns and herbs, April 1978, *C. Ochoa 12534* (OCH).

Solanum chomatophilum f. *sausianense* × *S. multiinterruptum*?? Plants vigorous, more than 1 m tall. Stem internodes elongate, 5-6 cm long. Leaves with 2-3 pairs of leaflets and 0-2 pairs of interjected leaflets. Leaflets long elliptic-lanceolate, with a pointed apex and a cuneate base, the lateral leaflets obliquely rounded at base, subsessile, with only the first upper pair of leaflets narrowly decurrent about the rachis. Inflorescence cymose-paniculate; pedicels up to 40 mm long, articulated about 3-4 mm below the base of the calyx. Corolla rotate, pale blue-violet, very large, 5.5-6.0 cm in dia.

Department Ancash

Province Huaraz: Chamilla, *ca.* 3500 m alt., near Huanchay, on stony hillsides in shrubby thickets with an understory of herbs in moist soil, 9 June 1983, *J. Espejo Ruiz 006* (OCH).

Table 9. Fertility of *Solanum chomatophilum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	INGAEFOLIA	× *S. ingaefolium*	6(8)	2(8)	58(0)
			× *S. raquialatum*	73(89)	18(45)	35(42)
24	1	LIGNICAULIA	× *S. lignicaule*	25(10)	16(2)	47(0)
24	1	MEGISTACROLOBA	× *S. dolichocremastrum*	44(12)	18(4)	64(0)
24	1	PIURANA	× *S. humectophilum*	243(15)	117(7)	77(43)
			× *S. hypacrarthrum*	11(71)	6(0)	0(0)
24	1	SIMPLICISSIMA	× *S. simplicissimum*	8(11)	6(5)	0(0)
24	1	TUBEROSA	× *S. chancayense*	4(17)	3(9)	200(0)
			× *S. immite*	13(29)	7(11)	71(0)
			× *S. mochiquense*	29(3)	20(0)	159(0)
			× *S. wittmackii*	6(7)	0(2)	0(0)
24	2	CONICIBACCATA	× *S. contumazaense*	16(79)	2(0)	0(0)

			× *S. irosinum*	3	2	100
			× *S. laxissimum*	50(6)	18(3)	88(0)
			× *S. limbaniense*	7(20)	2(15)	125(0)
			× *S. rhombilanceolatum*	9(50)	5(45)	22(43)
			× *S. santolallae*	3(5)	1(5)	0(0)
			× *S. urubambae*	6	3	0
24	2	CUNEOALATA	× *S.* × *blanco-galdosii*	9	3	73
			× *S. peloquinianum*	47(23)	22(15)	40(19)
24	2	INGAEFOLIA	× *S. jalcae*	184(126)	151(10)	88(57)
24	2	MEGISTACROLOBA	× *S. megistacrolobum*	10	8	16
			× *S. raphanifolium*	11(8)	7(3)	0(0)
			× *S. sogarandinum*	68(12)	36(3)	42(0)
24	2	PIURANA	× *S. aridophilum*	16(19)	6(14)	38(0)
			× *S. cantense*	29(26	7(0)	58(0)
			× *S. chiquidenum*	12(11)	7(8)	3(7)
			× *S. paucissectum*	26(24)	7(22)	8(21)
			× *S. piurae*	57(268)	30(61)	66(66)
24	2	TUBEROSA	× *S. ambosinum*	49(28)	16(18)	0(0)
			× *S. bukasovii*	87(86)	65(52)	18(42)
			f. *multidissectum*	10(18)	6(6)	3(65)
			× *S. goniocalyx*	4(46)	4(23)	0(0)
			× *S. huancabambense*	8(6)	0(5)	0(150)
			× *S. huarochiriense*	20(21)	4(15)	18(5)
			× *S. marinasense*	9	7	0
			× *S. medians*			
			var.autumnale-2x	30(10)	27(8)	42(11)
			× *S. multiinterruptum*	27(10)	20(10)	31(0)
			× *S. phureja*	130(43)	96(17)	3(11)
			× *S. saxatilis*	39(25)	23(24)	5(8)
			× *S. sparsipilum*	10(14)	3(10)	12(6)
48	2	ACAULIA	× *S. acaule*	28(168)	17(136)	31(70)
72	4	ACAULIA	× *S. albicans*	90(100)	67(55)	7(14)
72	4	CONICIBACCATA	× *S. jaenense*	13(63)	2(22)	12(0)

FL=total number flowers pollinated, TB=total number berries obtained, RB=average number seeds per berry.

Breeding Potential

The results of experimental crosses of *S. chomatophilum* with diploid species (2n=24 and EBN=1 or 2), tetraploids (2n=48 and EBN=2) and hexaploids (2n=72 and EBN=4) are given in Table 9, and the field numbers of the plants used in these crosses are cited in Table 10.

In line with the author's initial expectations, the reciprocal crosses of *S. chomatophilum* with *S. rhombilanceolatum* were totally compatible. However, the crosses involving *S. chomatophilum* and *S. limbaniense* yielded good results only when *S. chomatophilum* was used as the male parent, despite the fact that all three species are of the same series, ploidy number and EBN. Similar results were obtained in crosses involving *S. cantense* and *S. ariduphilum* of series Piurana and with *S. megistacrolobum* of series Megistacroloba. However, in reciprocal crosses involving *S. chiquidenum* and *S. piurae* (also of series Piurana), the results were totally compatible in both directions and little different from that obtained in crosses involving *S. jalcae* of series Ingaefolia. A similar case of complete compatibility occurred in crosses involving *S. peloquinianum*, although the series to which it belongs, Cuneaolata, is quite distantly related. Furthermore, the forma *sausianense* of *S. chomatophilum* was totally compatible with *S. peloquinianum* when used in unilateral crosses. Also of interest is the fact that unilateral crosses of *S. chomatophilum* with either *S. blanco-galdosii* or *S. megistacrolobum* were easily accomplished even though the series involved are far removed from the series Conicibaccata.

With regard to the putative origin of *S. albicans*, it is of interest to note that from the evolutionary standpoint, reciprocal crosses of *S. chomatophilum* and tetraploid *S. acaule* (EBN=2) were obtainable in both directions with ease, as was also the case in reciprocal crosses involving hexaploid *S. albicans* (EBN=4), both series Acaulia. Thus, it is understandable why the reciprocal crosses involving *S. chomatophilum* and *S. sogarandinum* (another supposed progenitor of *S. albicans*) yielded only partially compatible results, with good berry and seed set occurring only when *S. chomatophilum* was used as the female parent.

Finally, complete compatibility in both directions was found in reciprocal crosses involving *S. ambosinum*, *S. goniocalyx* and *S. raphanifolium*, and in the unilateral cross involving *S. marinasense*. These last four species belong to the series Tuberosa, while the reciprocal crosses made with *S. contumazaense* and *S. santolallae* and the unilateral cross with *S. urubambae* were all made within the series Conicibaccata. The cited species are all diploids with EBN=2.

Table 10. Collections (OCH) used in *Solanum chomatophilum* fertility studies.

SERIES ACAULIA

S. acaule 8611, 9012, 9796, 9829, 10111, 10113, 11304, 11603, 11605, 11831, 11860, 11887, 11891, 11989, 12059, 12073, 12092, 13109, 13145, 13149, 13172, 13175, 13180, 13193, 14389, 14392, 14402
S. albicans 11842, 12063, 12067, 12068, 12088, 12089, 12090, 12091, 12094, 13014, 13238,13239, 13395, 14789

SERIES CONICIBACCATA
S. chomatophilum 10728, 11046, 11061, 11281, 11753a, 11755, 11764, 11856, 11858, 12056, 13010, 13012, 13196, 13198, 13199, 13200 13201, 13202, 13203, 13204, 13205, 13206, 13208, 13210, 13212, 13213, 13292, 13307 13309, 13319, 13325, 13332, 13341, 13343 13844, 13845, 14484, 14485, 14786, 14787 14788, 14791, 14824, 15258
S. chomatophilum f. *sausianense* 13840
S. *contumazaense* 14751
S. irosinum 11640
S. jaenense 14801
S. laxissimum 13188
S. limbaniense 14290, 14291, 14405
S. rhombilanceolatum 11869
S. santolallae 13628
S. urubambae 13783

SERIES CUNEOALATA
S. blanco-galdosii 13009
S. peloquinianum 13002, 13230, 13231

SERIES INGAEFOLIA
S. ingaefolium 11614
S. jalcae 13344, 14490, 14782, 14785
S. raquialatum 13947, 13950, 13951, 13957, 13958, 14823

SERIES LIGNICAULIA
S. lignicaule 11317, 11617, 13584

SERIES MEGISTACROLOBA
S. dolichocremastrum 12071, 12074
S. megistacrolobum 14272
S. raphanifolium 14318, 15628
S. sogarandinum 13006, 13324, 13336

SERIES PIURANA
S. ariduphilum 2637
S. cantense 14681, 14692, 14746, 14818
S. chiquidenum 13965A, 13967
S. humectophilum 13247, 13250
S. hypacrarthrum 14715, 14731
S. paucissectum 11630, 11631, 11633, 11634, 14817
S. piurae 11615, 13954, 13959

SERIES SIMPLICISSIMA
S. simplissimum 15147

SERIES TUBEROSA
S. ambosinum 11865, 13852
S. bukasovii 11300, 11306, 11337, 11859, 11864, 11872, 13123, 13542, 13558, 13680, 13707, 13860, 13866, 14311, 14332, 14333, 15202
S. bukasovii f. *multidissectum* 11868, 13176, 13182
S. chancayense 11250
S. goniocalyx 00001
S. huancabambense 14815
S. huarochiriense 11329, 11331, 14517, 14525
S. immite 14491, 15184
S. marinasense 13689
S. medians-2x 11637, 13185
S. mochiquense 14870
S. multiinterruptum 11693, 12057, 12057A, 13234, 14696, 14718
S. phureja 5187, 5189, 9030, 13901, 14232, 14235, 15071, 15072, 15077, 15130, 15134, 15135,15136, 15332
S. saxatilis 15082
S. sparsipilum 11894, 13718, 13757
S. wittmackii 13154, 13184

7a. ***Solanum chomatophilum*** Bitt. var. ***subnivale*** Ochoa, Phytolgia 77(5):390-392, 1994. Fig. 39; Map 8.

Differs from the typical species by having much shorter and broader leaves, 11.0-15.5 cm long by 10.5-11.0 cm wide, much less divided, with 1-2(-3) pairs of lateral leaflets, without interjected leaflets; leaflets of the second lowest pair, when present, considerably smaller than the leaflets of the first pair; articulation of the pedicel near center or slightly below center; corolla stellate or substellate, large, 4.5 cm in diam., showy, violet-lilac with a dark purple internal star, lobes broadly triangular-lanceolate, 15-20 mm long by 10-12 mm wide at base, with an obtuse apex, the acumens obsolescent.

Type: PERU. Department of Ancash, Province Yungay, above Huishca, 4300 m alt., near snow line, in moist grassland and along the banks of streamlets from the melt waters of Huishca, 17 April 1978, C. *Ochoa 12084*, 2n=24 (holotype OCH, isotypes CIP, F, GH, MOL, NY, OCH, US).

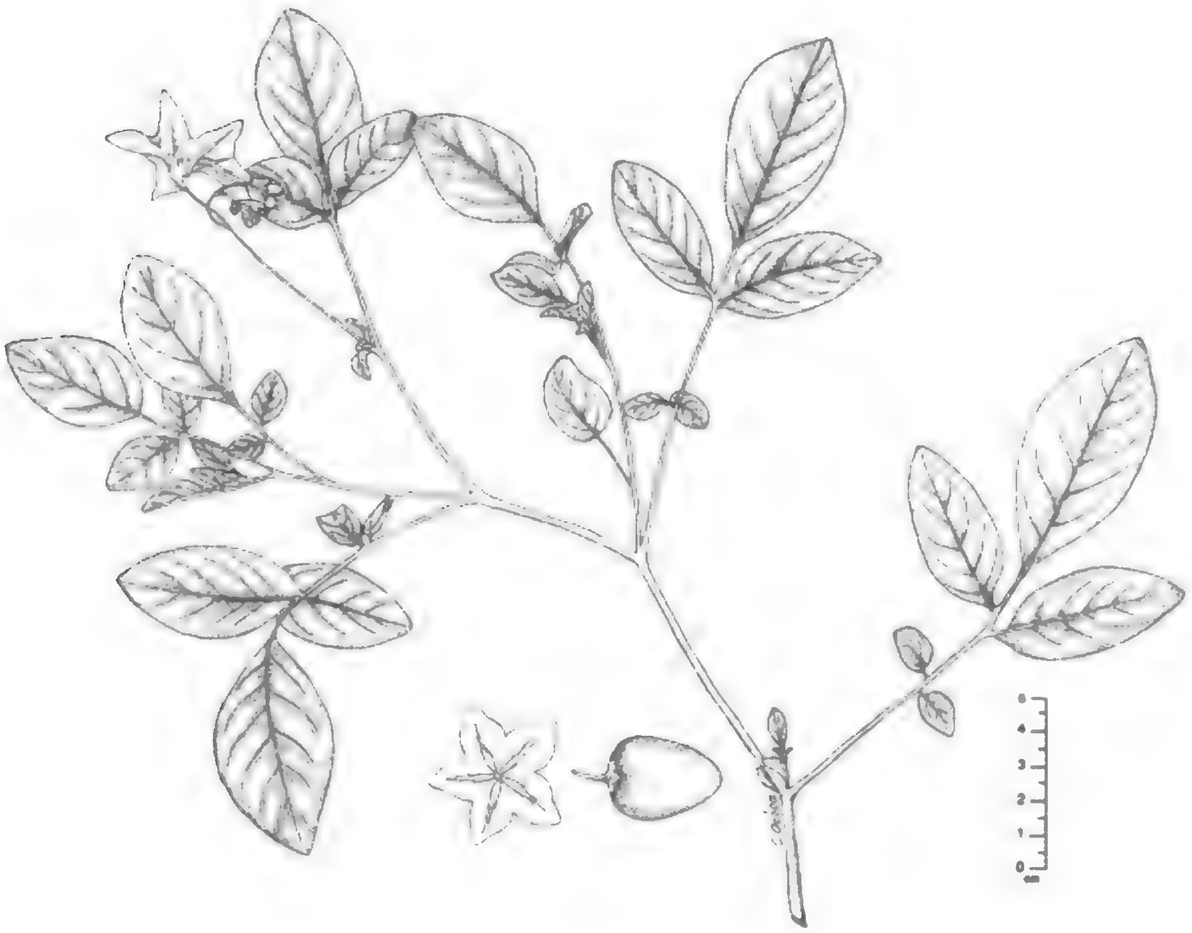


Figure 39. *Solanum chomatophilum* var. *subnivale* (*Ochoa 12084*).

Specimens Examined

Department Ancash

Province Carhuas: Quebrada Ulta, 4280 m alt., on the road to Ulta Pass (77°33' W, 9°08'S), forests of *Polylepis weberbauerii*, on pronouncedly rocky slopes looking toward the northwest, erect to climbing herb, flowers pale violet, 29 July 1985, *D.N. Smith 11385* (MO, UNTC).

Province Yungay: Above Huishca, 4300 m alt., near snow line, in moist grassland and along the banks of streamlets from the melt waters of Huishca, 17 April 1978, *C. Ochoa 12084*, 2n=24 (CIP, F, GH, MOL, NY, OCH, US, type collection of *S. chomatophilum* var. *subnivale*).

Department La Libertad

Province Pataz: Cueva Negra, near Tuco, 3800 m alt., btween Tayabamba and Huancaspata, in moist, very black soils, 21 June 1971, C. *Ochoa 3024*, leaves little divided with the terminal leaflet somewhat larger than the laterals and flowers varying from rotate to pentagonal (F, GH, NY, OCH, US).

7b. *Solanum chomatophilum* Bitt. f. *sausianense* Ochoa, Phytologia 77(5):391, 1994. Fig. 40; Map 8.

Differs from the typical species in being more robust, taller and more branched; always with long stem internodes. Leaves little divided with 1-2(-3) pairs of leaflets and 0-1 pairs of very small interjected leaflets; leaflets larger, longer and narrowly lanceolate, always with a pointed to acuminate apex and a conspicuously petiolulate base. Corolla rotate-pentagonal, 3 cm in dia., always lilac with a whitish-gray internal star.

Type: PERU. Department Huánuco, Province Huamalíes, *jalcas* of Condorcancha, near Sausián, 3580 m alt., 26 April 1967, *C. Ochoa 2646* (holotype OCH, isotype MOL).

Specimens Examined

Department Ancash

Province Huaylas: Quebrada de Vaquería, 3550 m alt., in forests of *Polylepis* sp., 26 December 1978, *C. Ochoa 13025* (OCH, CIP, USM).

Department Huánuco

Province Huamalíes: *Jalcas* of Condorcancha, near Sausián, 3580 m alt., between Tantamayo and Jircán, 26 April 1967, *C. Ochoa 2646* (MOL, OCH, type collection of *S. chomatophilum* f. *sausianense*). Heading down from the Carpa lagoon toward San Juan, 3450 m alt., Distr. Tantamayo, flowers violet-lilac, in *jalca* grassland and forests of *Polylepis* sp., 15 April 1980, *C. Ochoa 13840* (CIP, MOL, OCH, US, USM).

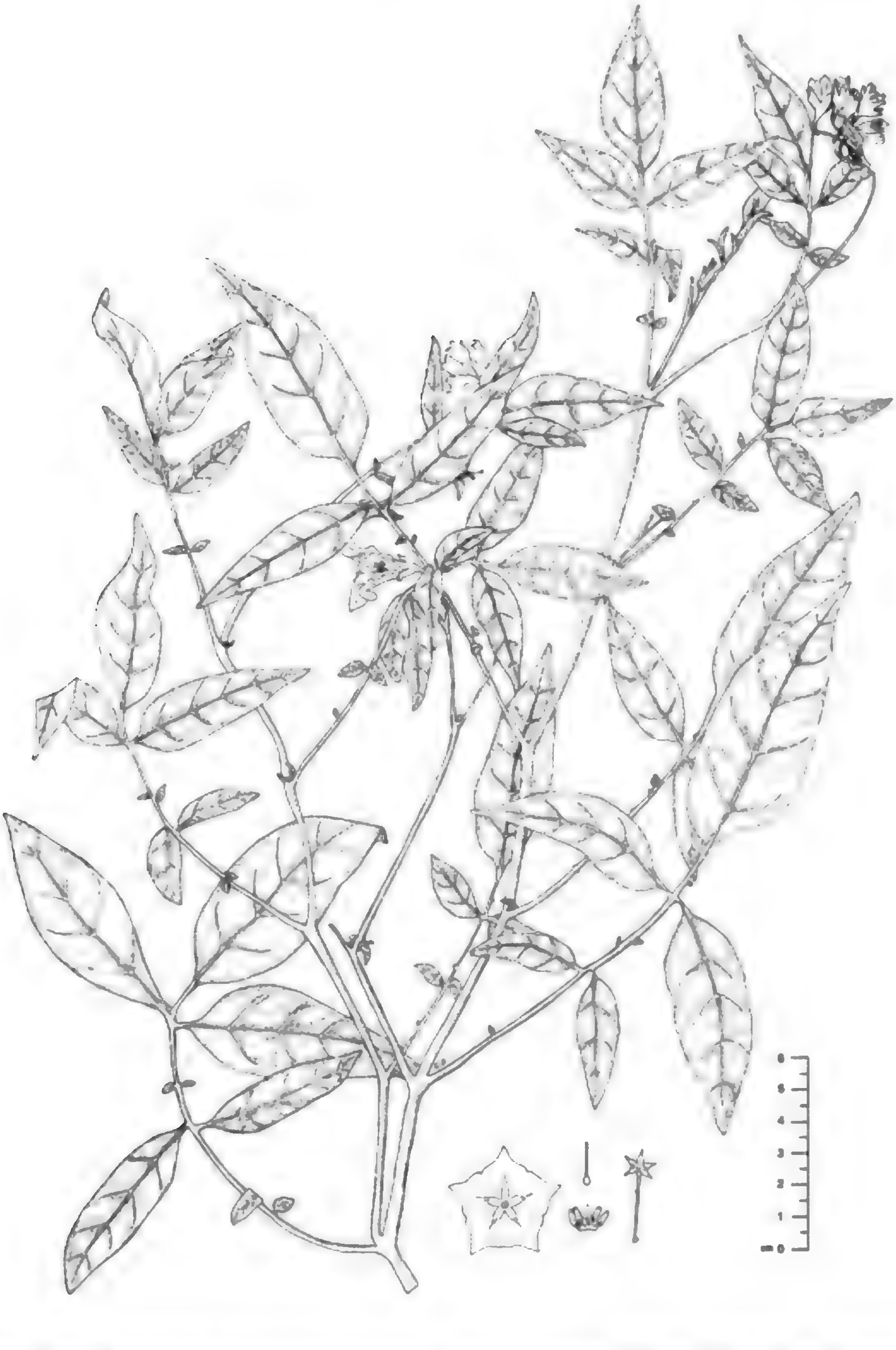


Figure 40. *Solanum chomatophilum* f. *sausianense* (*Ochoa 2646*, holotype).

8. *Solanum irosinum* Ochoa, Am. Potato J. 58(3):131-133, 1981.

Figs. 41-43; Map 9; Plate V.

Plants vigorous, erect, (30-)50-70 cm tall, sparsely pilose to pubescent. Stems straight or slightly flexed, simple or branched, 8-10 mm in dia. toward the base, light green or pigmented with light violet toward the basal one-third of its length and in the leaf axils, very shortly and sparsely pilose, wings narrow, straight and sinuous; internodes (2-)4-6 cm long. Stolons 1 m or more long; tubers white, round to ovoid, moniliform,1.5-2.0 cm in dia., or occasionally only single and large, long cylindrical or subcylindrical, 7 cm long by 2.5-3.0 cm in dia. Leaves dark green, imparipinnate, with 4(-5) pairs of leaflets and 2-5(-7) pairs of interjected leaflets, (10.0-)12.0-20.0(-20.5) cm long by (8.0-)9.5-11.0(-17.0) cm broad, sparsely pilose or pubescent above including on the rachis and petiole, and somewhat less pilose along the lower veins and veinlets. Lateral leaflets elliptic-lanceolate, the apex pointed and the base rounded to obliquely rounded, on petiolules 1-3(-5) mm long. Terminal leaflet slightly larger than the first pair of lateral leaflets, (4.5-)5.5-7.5(-8.5) cm long by (2.0-) 2.5-3.0(-3.5) cm broad, the apex pointed and the base rounded to cuneate and very slightly decurrent on the petiolule. The Leaflets of the first and second pairs almost of the same size, (4.0-) 4.5-7.0(-8.0) cm long by (1.5-)1.7-2.0(-2.8) cm broad, generally with a short petiolule which is narrowly decurrent about the rachis, the remaining pairs diminishing gradually in size toward the leaf base. Pseudostipular leaves broadly falcate, 7-12 mm long by 4-6 mm broad. Inflorescence cymose to cymose-paniculate, 8-15(-20) flowered; peduncle 6-12(-15) cm long by 2 mm in dia. at base, sparsely pilose like the pedicels; pedicels 15-20 mm long, articulated in the upper one-third of their length or about 6-7 mm below the calyx. Calyx symmetrical or asymmetrical, sparsely pilose, lightly pigmented, small, 5-6 mm long; lobes broadly elliptic to ovate, the apex pointed or apiculate. Corolla rotate, 2.5-3.0 cm in dia., light purple or lilac with the internal star dark mauve-gray, lobes 5 mm long including the acumen; acumens very short, 2.0-2.5 mm long, the margins densely pubescent (Fig. 42). Staminal column subcylindrical-conical, anthers short and narrowly lanceolate, 4.5-5.0 mm long, base broad, 1.0-1.5 mm; filaments short, 0.5-0.7 mm long, glabrous. Style short, 7.5-8.5 mm long, pigmented lilac toward the apical two-thirds of its length, densely papillose on the basal three-quarters of its length, papillae mixed with fine hairs or short and sparsely distributed setae; stigma small, capitate, cleft. Fruit ovoid to oval-conical, somewhat compressed, light green, with 1-2 darker green vertical streaks, 20-25 mm long by 12-15 mm in dia. toward the base (fig. 43). Chromosome number: 2n=24. EBN=2.

Local Name: *Papa de Gentil* in the Province of Chota.

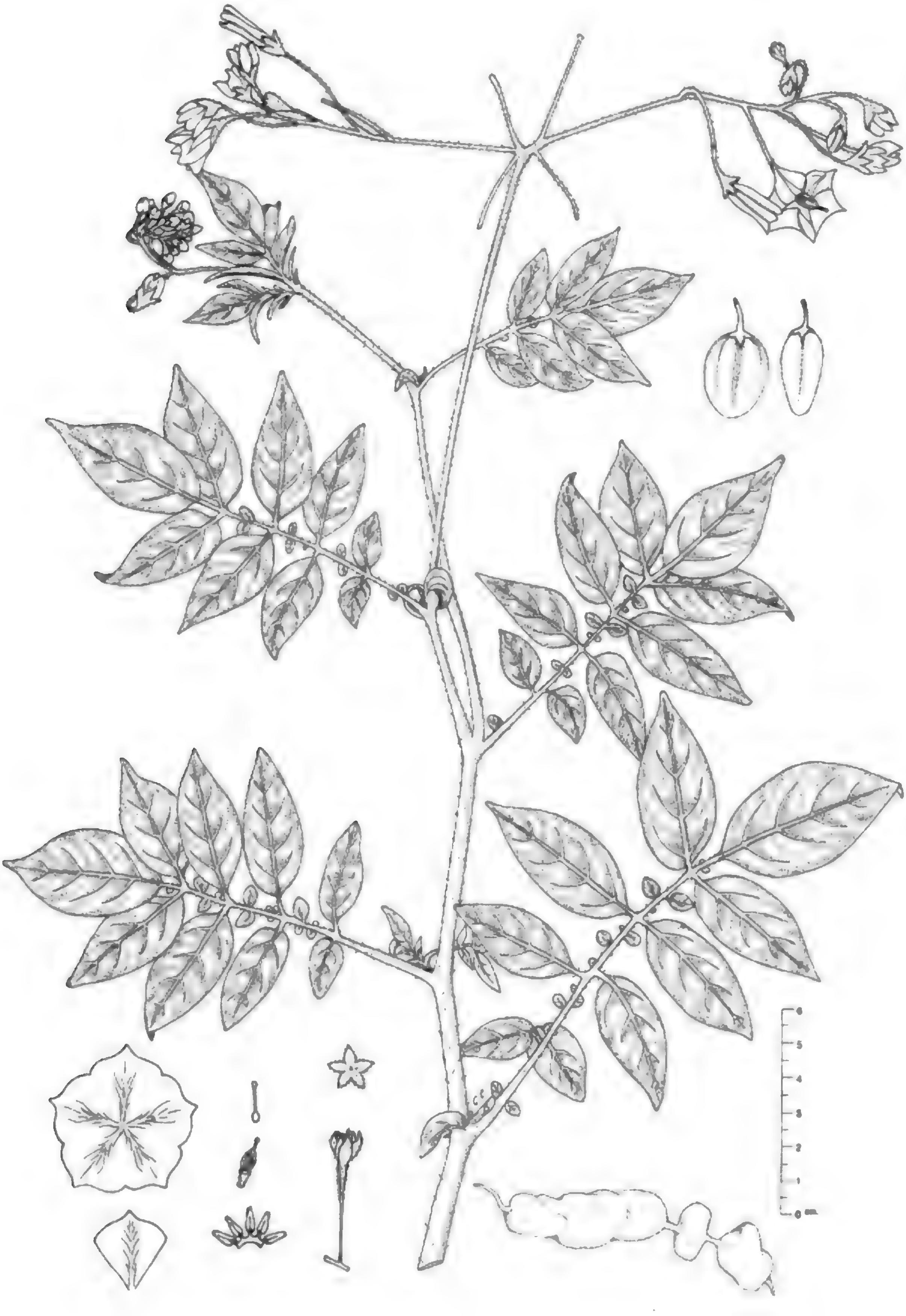


Figure 41. *Solanum irosinum* (*Ochoa 3608*, holotype).

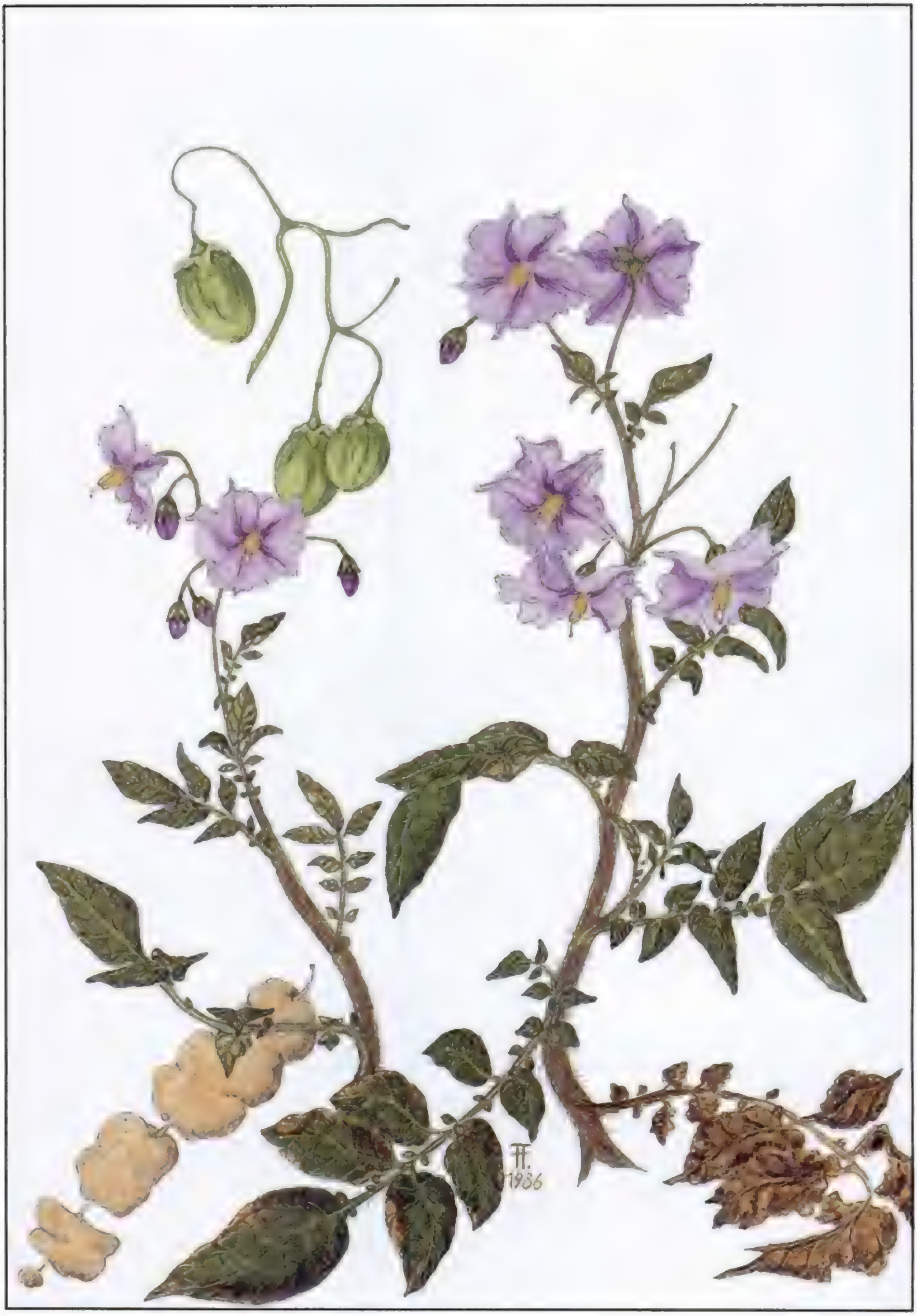


Plate V. *Solanum irosinum* Ochoa.

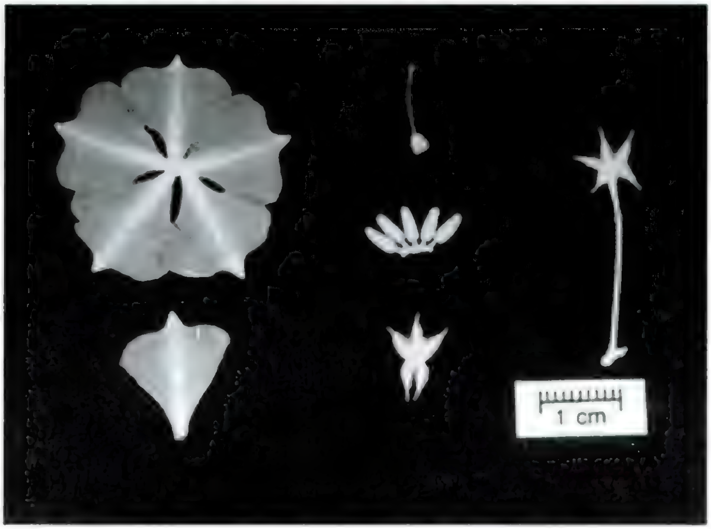


Figure 42. Floral dissection of *Solanum irosinum* (*Ochoa 11640*).

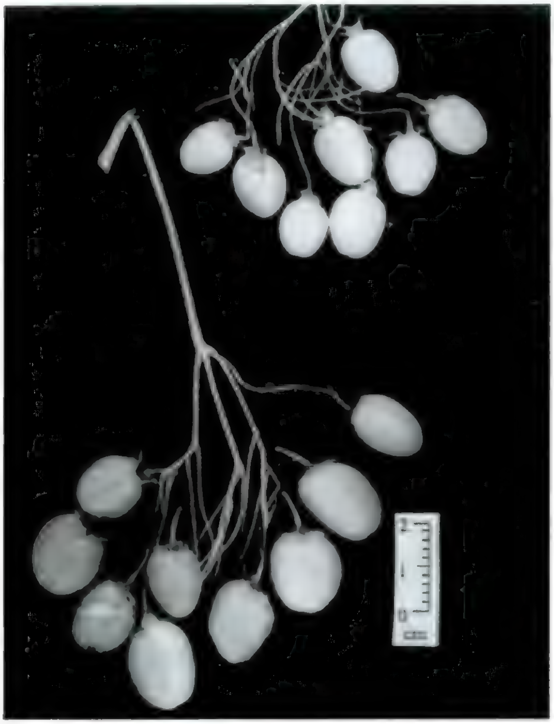


Figure 43. *Solanum irosinum* (*Ochoa 11646*).

Type: PERU. Department of Cajamarca, Province Chota, Cerros Iros, 3200 m alt., south of Chigrip, among relic shrubs of a cool cloud forest, 7 March 1973 (not 1963), *C. Ochoa 3608* (holotype OCH, designated here, isotype LE).

Affinities

Solanum irosinum is related to *S. chomatophilum*. The two are similar in habit, leaf shape, pedicel articulation and calyx size and shape. However, *S. irosinum* differs from the latter in being more densely pubescent over the entire plant. Moreover, the leaflets of this species are more narrowly lanceolate and terminate in a pointed to subacuminate apex. Also, the fruits are ovoid instead of long-conical.

Habitat and Distribution

Solanum irosinum thrives in cool, cloudy habitats, forming fairly large colonies in mountain clearings or on the borders of small shrub forests. It grows in very moist, sandy-clay soils rich in organic material. It is also found, though much more rarely, in open fields and in grasslands of *Stipa* sp., *Poa* and small shrubs of *Hypericum* and herbaceous ferns. It is known only from the Provinces of Chota and Cutervo of the Department of Cajamarca in northern Peru, at elevations ranging between 2600 to 3300 m.

Because of its resistance to *Phytophthora infestans*, as well as its great tolerance to frost and/or abrupt temperature changes, this species may prove someday to be of great value to the plant breeder.

Specimens Examined

Department Cajamarca

Province Chota: On the middle slopes of Cerro Iros, 3000 m alt., south of Chigrip, flowers violet or dark lilac, tubers 3-5(-7) cm long, white, irregular in shape and size, usually ovoid moniliform and long subcylindrical, berries long-conical with an obtuse apex, 30 April 1972, *C. Ochoa 3303* (topotype OCH). On the upper slopes of Cerro Iros, 3200 m alt., heading upwards about 5 km south of Chigrip, among stands of relic shrubs associated with *Stipa* and other grasses, *Hypericum* sp. and ferns, is resistant to *Phytophthora infestans,* 7 March 1973 (in the original diagnosis of this species, the year was inadvertently indicated as 1963), *C. Ochoa 3608*, 2n=24 (LE, OCH, type collection of S. *irosinum).*

Cerro Iros, 3250 m alt., among shrubs, 5-11 June 1977, *C. Ochoa 11640*, 2n=24 (topotypes CIP, GH, MO, MOL, OCH, US, USM), and *11641* (topotypes CIP, MOL, OCH).

Province Cutervo: Cerro Angurra, 2600 m alt., near Cutervo, 5-11 June 1977, *C. Ochoa 11646*, 2n=24 (CIP, GH, MO, MOL, OCH, US, USM). E1 Remate, 3350 m alt., about 10 km north-northeast of Llipa, along forest margins or among shrubs, in very moist organic soil, 5-11 June 1977, *C. Ochoa 11667*, 2n=24 (CIP, MOL, OCH, USM). La Coronilla, 2800 m alt., above Pajcha, along the bridle trail from Socota towards Pampa Grande, along forest margins and between shrubs with dense colonies of *Chusquea* sp., *n.v. Papa de Gentil*, stems triangular, winged, berries long-conical with an obtuse apex, 27 May 1983, *C. Ochoa and A. Salas 15210*, 2n=24 (CIP, GH, MO, MOL, OCH, US, USM), and *15211* (CIP, MOL, OCH). District of Socota, Laurel, 2600 m alt., between La Capilla and Paicha, in very moist black soil, grass cover, flowers dark violet, 29 May 1983, *C. Ochoa 15225*, 2n=24 (CIP, GH, MOL, OCH, US, USM), and *15226*, 2n=24 (CIP, MOL, OCH, US, USM). Quebrada of Cerro Tapo, 2800 m alt., between Pajcha and Llipa, in soils covered with grasses and herbaceous ferns, 30 May 1983, *C. Ochoa and A. Salas 15227*, 2n=24 (CIP, OCH).

8a. *Solanum irosinum* Ochoa f. *tarrosum* Ochoa. (See Latin diagnosis in Spanish edition). Fig. 44; Map 9.

Plants vigorous, erect-ascending to erect-decumbent, 2 m tall. Stems 15 mm in dia. at base, winged, glabrous or glabrescent, pigmented on the basal two-thirds of its length and in the axils. Stolons 1-2 m long; tubers white-opaque to white-glassy, cylindrical or subcylindrical, 8-9 cm long by 3.0-3.5 cm in dia. Leaves imparipinnate, usually with 4 pairs of leaflets and 0-3 pairs of interjected leaflets, 12-20 cm long by 8.5-11.5 cm broad, including the petiole. Leaflets narrowly elliptic-lanceolate or elliptic-lanceolate, the apex pointed and the base obliquely rounded, subsessile or shortly petiolulate, short and sparsely pilose above, glabrous or with a few short hairs on the nerves below. Inflorescence cymose, few flowered (2-3). Peduncle short, 3 cm long, slender, 1.2 mm in dia.; articulation scarcely distinguishable, always above center or to 5 mm below the base of the calyx. Calyx asymmetrical with 1-2 pairs of united lobes. Corolla rotate, 2.0-2.5 cm in dia., lilac, with the white border star extending from the acumen toward the base of the petals. Fruit long-conical. Chromosome number: 2n=24.

Type: PERU. Department of Cajamarca, Province Cutervo, San Andres district, on the foothills of Cerro Tarros, 2800 m alt., 4 June, C. Ochoa and A. Salas 15243 (holotype OCH, isotypes CIP, MOL).

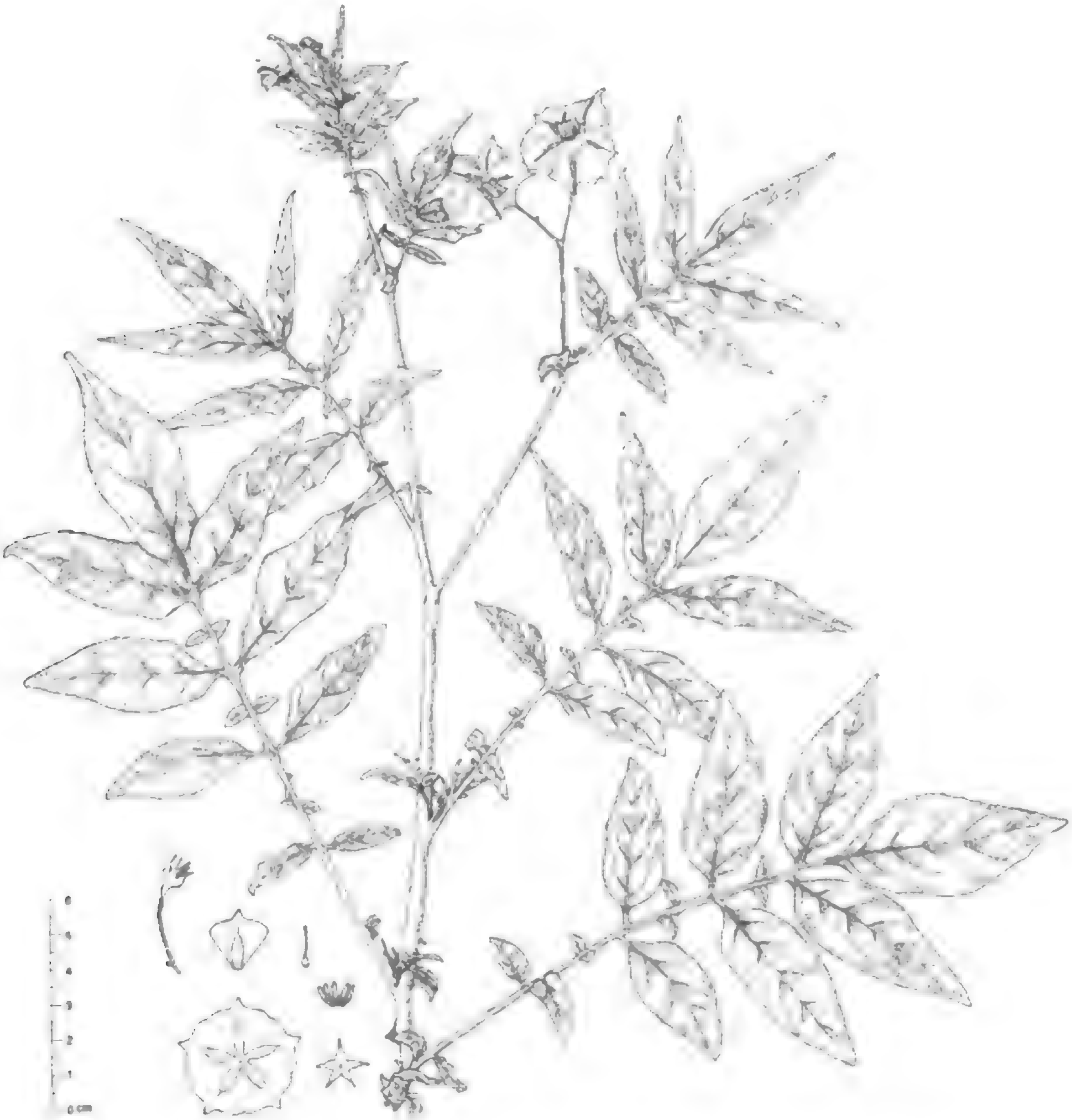
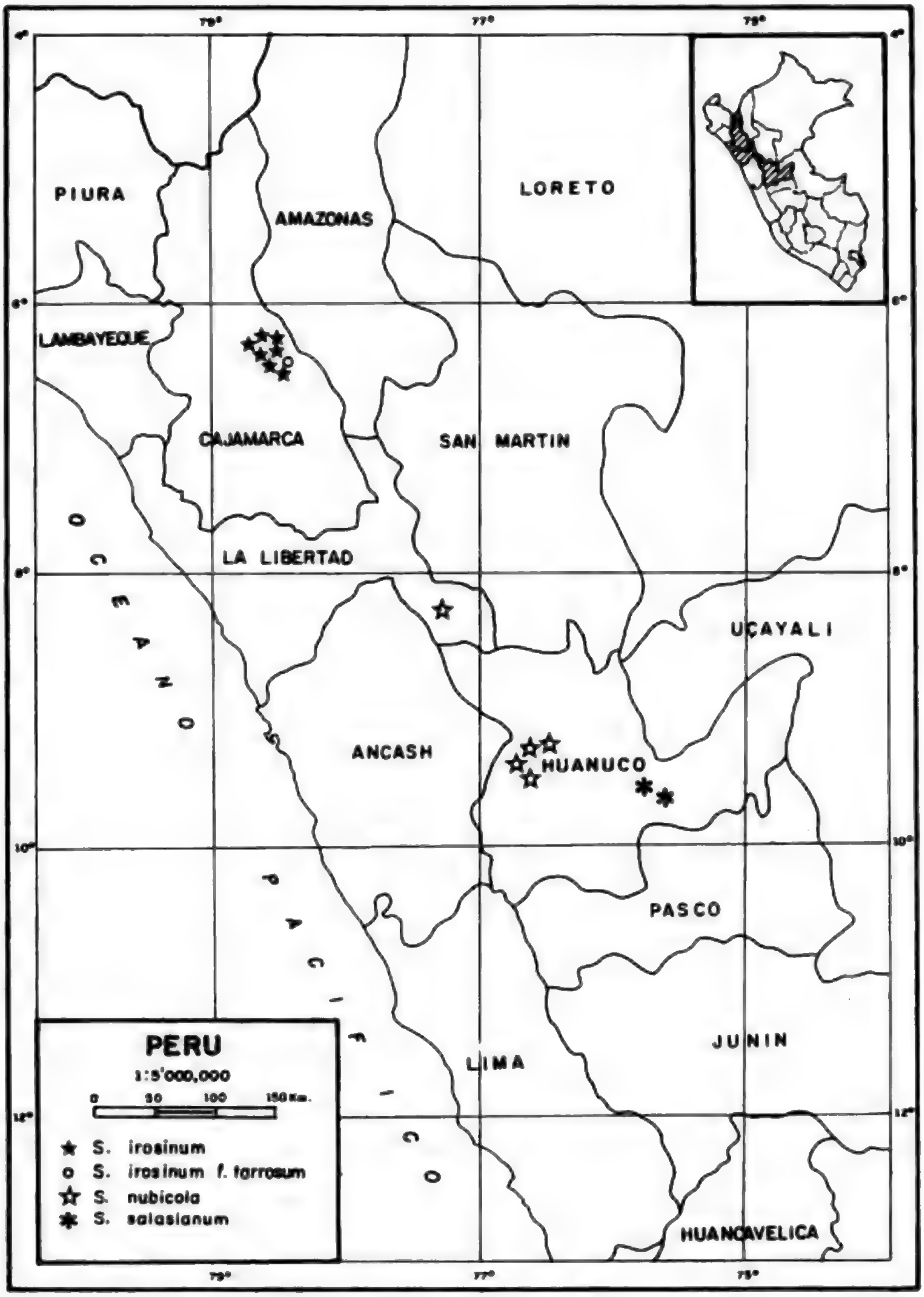


Figure 44. *Solanum irosinum* f. *tarrosum* (*Ochoa 15243*, holotype).



Map 9. Distribution of *Solanum irosinum, S. irosinum* f. *tarrosum, S. nubicola* and *S. salasianum*.

Habitat

Among evergreen forests or clearings in forests of trees and shrubs with an understory of many herbs, distinguished principally by *Cedrella*, *Chusquea*, *Embothrium*, *Eugenia*, *Oreopanax* and *Weinmannia* and various species of ericads and melastomes.

Specimen Examined

Department Cajamarca

Province Cutervo: Lower slopes of Cerro Tarros, 2800 m alt., among mountain shrubs and trees represented by *Cecropia*, *Eugenia* and *Quercus*, large colonies of *Chusquea* sp., many melastomes, tree and herbaceous ferns, May 1983, *C. Ochoa and A. Salas 15243*, 2n=24 (CIP, MOL, OCH, type collection of *S. irosinum* f. *tarrosum*).

Breeding Potential

Due to a lack of material, very few crosses of *S. irosinum* were performed. Only unilaterial crosses of *S. irosinum* (2n=24 and EBN=2) × *S. guzmanguense* (2n=24 and EBN=1) and of *S. irosinum* × *S. contumazaense* (2n=24 and EBN=2) were carried out. In both cases, no berries were formed.

9. *Solanum jaenense* Ochoa, Agronomía, Lima 27(4):370-372, illustr., 1960.

Figs. 45-47; Map 7.

Plant erect, small, 25-30 cm tall, subglabrous. Stem slender, 3-4 mm in diameter at base, usually simple, slightly sinuous, very narrowly straight-winged, internodes 1.5-2.0 cm long, glabrous or subglabrous, lightly pigmented on the basal one-third of its length and in the leaf axils. Stolons 40 cm long by 1.5 mm in dia., white; tubers round to ovoid, 1.5-3.0 cm long, white, with semi-deep eyes. Leaves long petioled, light green, subglabrous or glabrous, with a smooth surface, (6-)9-13(-17) cm long by (2.5-) 4.0-7.0(-10.0) cm broad including the petiole, imparipinnate, with (2-)3-4(-5) pairs of leaflets and (1-)2-3(-4) pairs of sessile interjected leaflets, ovate to orbicular, 2-5 mm long. Terminal leaflet slightly larger and broader than the laterals, (3.0-)3.5-4.5(-5.0) cm long by 1.7-2.2(-2.8) cm broad, elliptic-lanceolate, the apex pointed or shortly acuminate and the base slightly attenuate to cuneate, narrowly decurrent about the rachis and with 0-1 pairs of small interjected leaflets on the petiolule; lateral leaflets narrowly lanceolate, subsessile or shortly petiolulate, the apex pointed or shortly acuminate

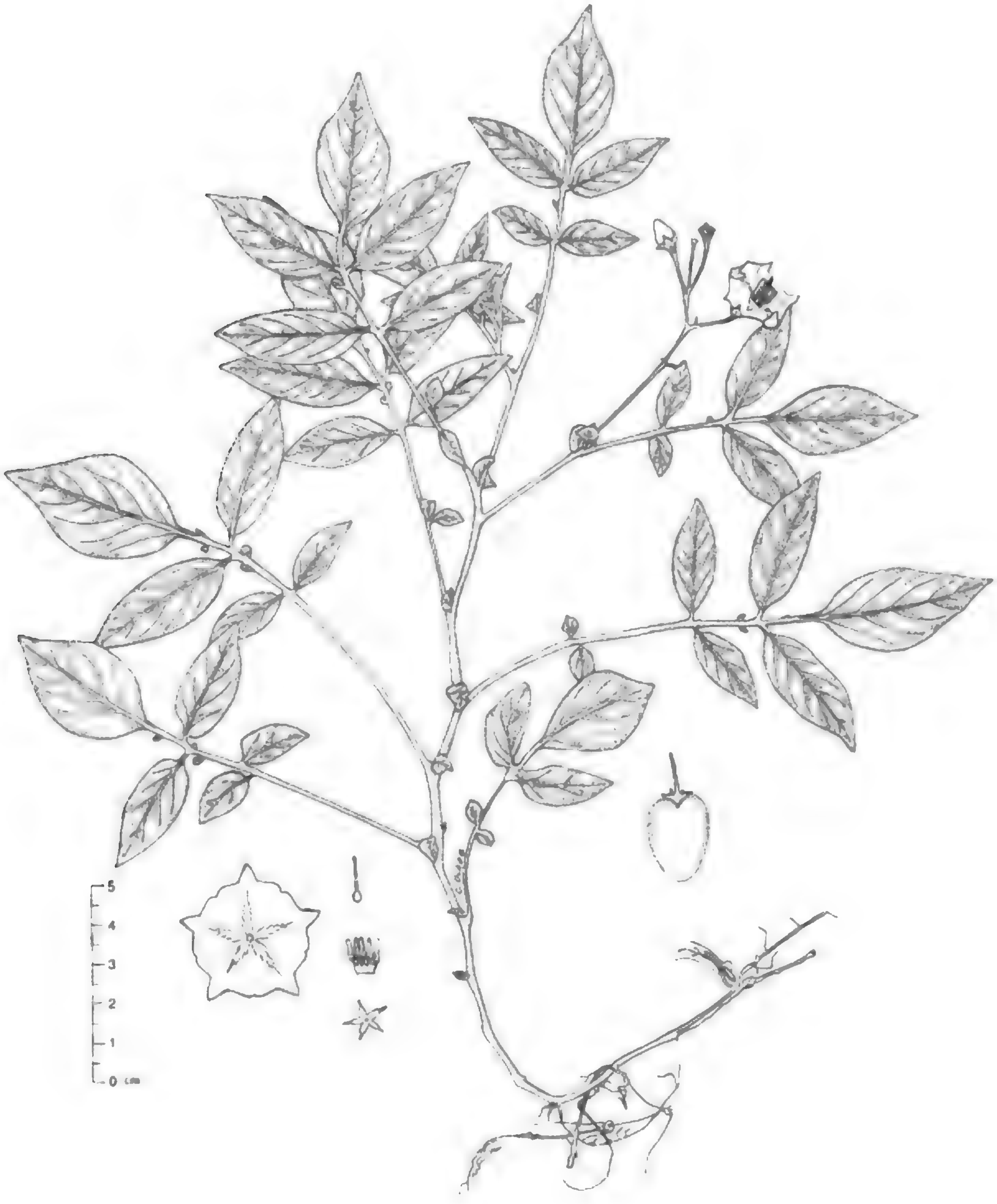


Figure 45. *Solanum jaenense* (*Ochoa 2328*, holotype).

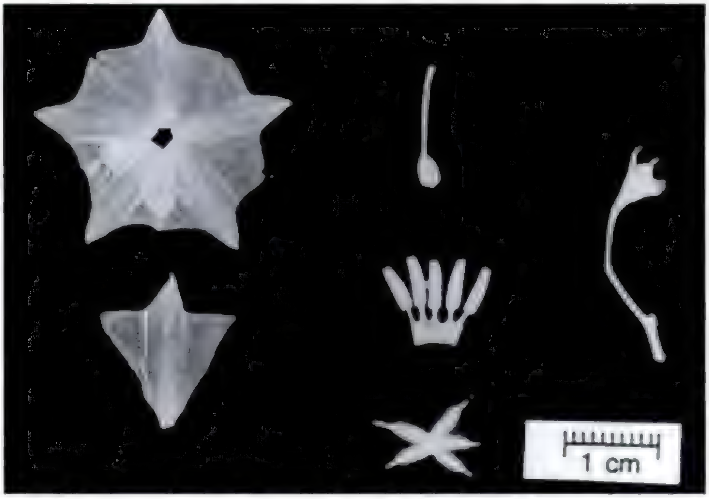


Figure 46. Floral dissection of *Solanum jaenense* (*Ochoa 14801*).

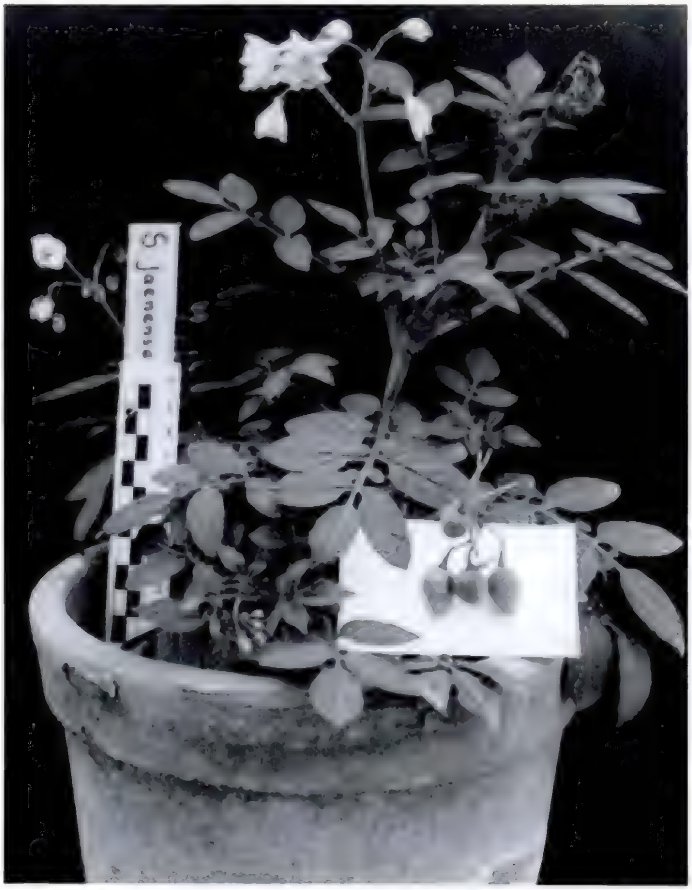


Figure 47. *Solanum jaenense*, Cajamarca.

and the base slightly asymmetrical or symmetrically rounded; petiolules 1-2 mm long; the first pair of leaflets larger than the leaflets of the second and following pairs, 2.3-4.0 cm long by 1.0-1.4 cm broad. Pseudostipular leaves subfalcate or asymmetrical and narrowly elliptic, 5-10 mm long by 2.5-7.0 mm broad. Inflorescence cymose, lateral or terminal, 4-6(-10) flowered. Peduncle 5-9 mm long by 1.5-2.0 mm in dia. at base, forked, light green, generally glabrous like the pedicels and calyx; pedicels short, 15-20 mm long; inconspicuously articulated near the midpoint or occasionally slightly the below center, usually about 7-9 mm below the base of the calyx. Calyx symmetrical or asymmetrical, small, 5-6 mm long, subglabrous; lobes narrowly elliptic-lanceolate, broadly membranous, apex very shortly acuminate. Corolla rotate, white, small, 2.0-2.5 cm in dia. (Figs. 45, 46), the internal star white-hyaline and the lobes puberulent externally, margins of the acumens finely pilose. Anthers pale yellow, narrowly elliptic-lanceolate or lanceolate, 5.5 mm long; filaments 1.0-1.8 mm long, slender, glabrous. Style 8.0-8.5 mm long, exerted 2 mm, glabrous or occasionally very shortly and sparsely papillose on the basal one-third of its length; stigma capitate, small, slightly enlarged at apex. Fruit long-conical 1.8-2.2 cm long, light green (Fig. 45). Chromosome number: 2n=72. EBN=4.

Type: PERU. Department of Cajamarca, Province Jaén, Cuesta de Huascarai, 2700 m alt., 5 May 1960, C. *Ochoa 2328* (holotype OCH, isotype MOL).

Affinities

Contrary to what Correll stated in his1962 monograph, *S. jaense* is more closely related to the Ecuadorian *S. tundalomense* than to *S. chomatophilum*. Both species are hexaploid (2n=72), and have small white corollas and similarly-appearing fruits and leaves. *S. tundalomense*, however, is a larger and more vigorous plant. More extensive field collections and comparative studies of living plants are needed, however, in order to better clarify the existing relationships between these two.

Habitat and Distribution

Solanum jaenense thrives in the cool and rainy climate of the Huascarai Mountains that form the borderline between the Departments of Piura and Cajamarca in northern Peru (Map 7). It grows along the margins of tree forests and in thickets formed by such herbs and shrubs as *Hedyosomum huascarai*, *Miconia caelata*, *Gleichenia affinis*, *Salvia florida* and various calceolarias, composites and grasses, at elevations between 2700 and 2800 m.

Specimens Examined

Department Cajamarca

Province San Ignacio (formerly Province Jaén): Cuesta de Huascarai, 2700 m alt., along the railroad between Jaén and Tabaconas, 5 May 1960, C. *Ochoa 2328* (MOL, OCH, type collection of *S. jaenense*).

Department Piura

Province Huancabamba: Between Chorro Blanco and Cruz Chiquita, 2800 m alt., near the mountain pass of Huascarai, on the bridle trail from Huancabamba to Tabacomas, flowers white, fruits long-conical, near forest trees and scrub and herbs, associated with *Miconia*, *Calceolaria*, *Gleichenia* and *Salvia*, many composites and grasses, 23 May 1982, *C. Ochoa and A. Salas 14801*, 2n=72 (CIP, MOL, OCH, UNTC) and (CIP, OCH, USM, from plants reproduced in the greenhouse at Huancayo).

Breeding Potential

More than 60 reciprocal crosses of *S. jaenense 14801* (2n=72 and EBN=4) with *S. chomatophilum 13203* and *13307* were attempted at CIP. These crosses resulted in a total of 22 parthenocarpic berrries when *S. jaenense* was used as the female parent, and 2 berries containing an average of 12 seeds each (these with well formed embryos) when *S. jaenense* was used as the male parent.

10. *Solanum laxissimum* Bitt., Beibl. Engl. Bot. Jahrb, No. 119, 54:7-8, 1916.

Figs. 48-52 ; Map 5.

S. rockefelleri Vargas, *Las Papas Sudperuanas*, Publ. Univ. Nac. Cusco, Part II: 2, 54-55, Fig. 7, 1956 (as *S. rockefelleriae*). Type: Peru, Dept. Cusco, Prov. Urubamba, Machu Pikchu, 2100 m alt., 4-5 January 1946, *C. Vargas C. 5548* (CUZ, OCH).

S. laxissimum Bitt. f. *rockefelleri* (Vargas) Correll, Wrightia 2:175, 1961. Type: Same as *C. Vargas C. 5548* (CUZ, OCH).

S. claviforme Corr., Wrightia 2:174, 1961 (as *S. claviformum*). Type: Peru, Dept. Huánuco, at km 60 between Huánuco and Tingo María, 28 May 1946, *C. Swingle 66* (US).

S. parvicorollatum Lechn., Lenin Academy of Agricultural Sciences. Bull. Vavilov Inst. of Pl. Industry. Tuber Crops. Fasc. 105, 12-13, 1980. Type: Peru,

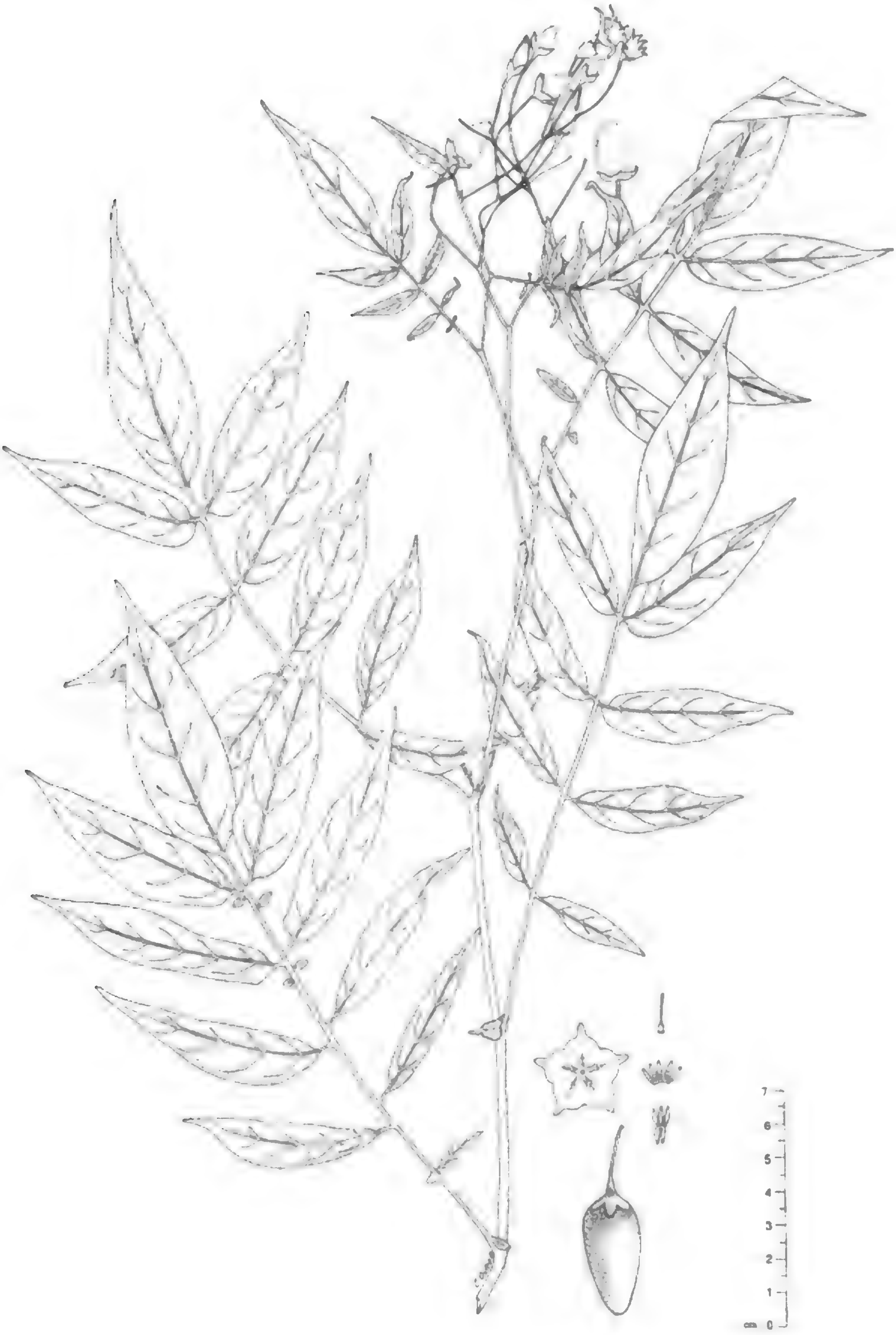


Figure 48. Plant, floral dissection and fruit of *Solanum laxissimum* (*Ochoa 14358*).

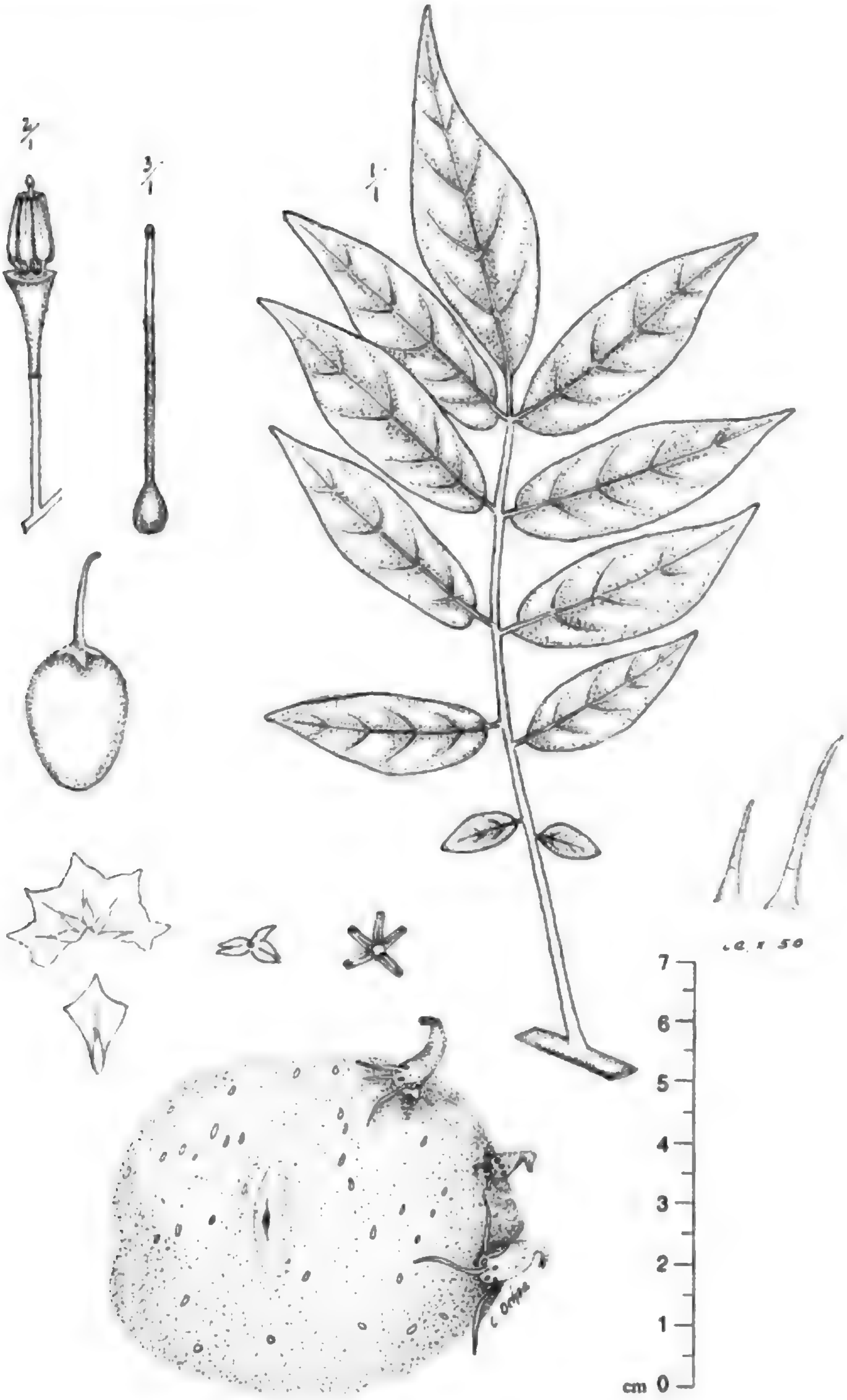


Figure 49. Details of the floral parts, fruit, leaf and tuber of *Solanum laxissimum* (*Ochoa 3300*).

Huancayo, 2600 m alt., Villarica, Tarma, Junín (WIR N° *K-9128*, 303020, plants propagated from original seed at the Experimental Station. of Pushkin in September 1979, with No. *3* by *L. M. Turuleva*, not seen*).

Plant robust, lax-ascending or erect-decumbent, 1-3(-4) m tall, glabrous or subglabrous. Stem vigorous, simple or branched, 2 cm in dia. at the base, straight or somewhat sinuous, lightly pigmented at the base and in the leaf axils, wingless or very narrowly winged, hairs very sparse and very short, scarcely distinguishable; internodes (4-)6-8(-12) cm long. Stolons 1.5 cm long; tubers conspicuously long, 12-15 cm in length, ovoid or elongate (Fig. 51), white-skinned with numerous lenticels, superficially semi-deep eyes and creamy-white flesh. Leaves imparipinnate with (4-)5-6(-7) pairs of lateral leaflets and 0-2(-3) pairs of interjected leaflets, glabrous or very sparsely pubescent, especially on the upper rachis, finely and shortly pilose on the veins below; leaves lax and long, (16-)18-

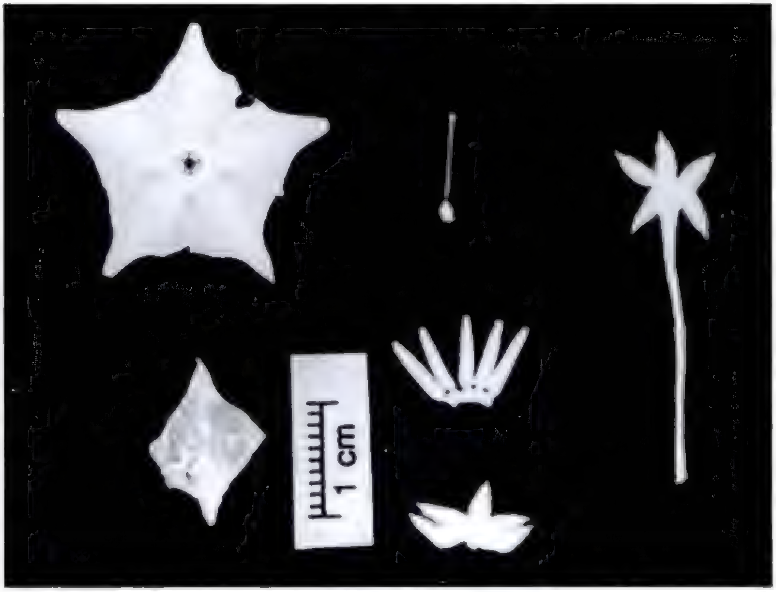


Figure 50. Floral dissection of a specimen of *Solanum laxissimum* collected from the Quebrada San Alberto (2000 m alt.), near Oxapampa, Pasco (*Ochoa 13158*).

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* The type locality of *S. parvicorollatum* given by Prof. Lechnovitch in his original diagnosis is inexact and confusing. Huancayo, the capital of the Department of Junín, is the site of the Universidad Nacional del Centro from where the original seed was sent. It lies at an elevation of 3300 m. However, Villarica, which is near 2600 m, is actually located in the Province of Oxapampa, Department. Pasco, which is north of the Dept. of Junín.

30(-40) cm long by (8.5-)11.0-15.5(-25.0) cm broad including the petiole. Leaflets narrowly elliptic-lanceolate or narrowly lanceolate, the apex long acuminate or attenuate and the base obliquely rounded to cuneate. Terminal leaflet rarely somewhat broader and longer than the laterals, (3.0-)6.5-8.5(-10) cm long by (0.8-)2.5-3.5(-4.5) cm broad, and with acuminate tips 10-20 mm long. First pair of lateral leaflets almost always somewhat smaller than that of the second and third pairs, (4.5-)5.5-7.5(-8.5) cm long by (1.5-)1.8-2.3(-3.0) cm broad, subsessile.

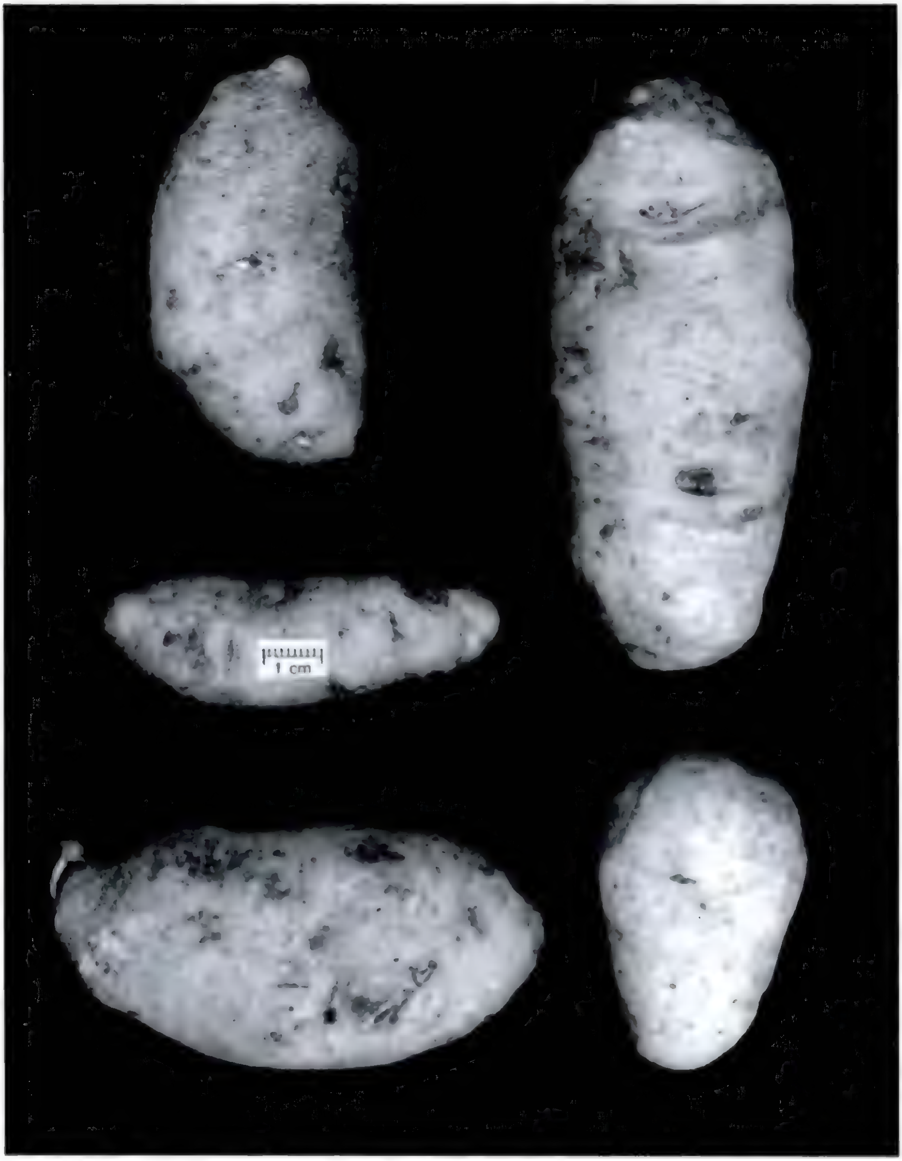


Figure 51. Tubers of *Solanum laxissimum* (*Ochoa 11855*, topotype).

Petiolules of the second and third pairs of leaflets 5-11(-18) mm long. Pseudostipular leaves obliquely ovate or narrowly ovate-lanceolate, rarely subfalcate, pointed or acuminate, 20 mm long by 7 mm broad. Inflorescence terminal or lateral, cymose-paniculate, showy, with (15-)20-30(-40) flowers. Peduncle (6-)8-11 cm long, slender, 2-3 times forked, glabrous or puberulent like the pedicels and calyx, pale or very light green; pedicels 20-25(-30) mm long, articulated near center or occasionally slightly below center, rarely above center, light green but the pigmentation below the articulation similar to the calyx. Calyx asymmetrical or symmetrical, pale or very light green, 6-7 mm long, lobes ovate to elliptic-ovate, apiculate or shortly acuminate, with scarious margins. Corolla pentagonal, purple or violet-lilac, lighter inside and darker externally, (2.0-)2.5-3.0 cm in dia., acumens prominent, 5 mm long, the apex puberulent (Fig. 50). Anthers lanceolate to oblong-lanceolate, 7 mm long; filaments 0.5-1.0 mm long, generally glabrous, very rarely shortly and sparsely pilose. Style 7.5-9.5 mm long, exerted (1.5-)2.0-3.0 mm, densely papillose on the lower two-thirds of its length (Fig. 49); stigma small and capitate. Fruit long-conical, the apex generally obtuse, uniformly light green, 2.5-3.0 cm long by 1.5 cm in dia. toward the base. Chromosome Number: 2n=24. EBN=2.

Local Names: At the Carpish-Huánuco Divide, the plant is called *Papa de Monte* and the fruit *Shaullinco*.

Type: PERU. Department Junín, Province Jauja [today Province Satipo], Valley of the Masamerich River, 3100 m alt., between the tambos of Atac and Calabaza, in evergreen forests of trees and shrubs, 25 April 1913, *A. Weberbauer 6640* (MOL, designated here as the lectotype, and isolectotypes F, GH, OCH, US).

In his 1962 work on the potatoes of Peru, the author treated *S. rockefelleri* as a synonym of *S. laxissimum* and *S. santolallae* (inclusive of var. *acutifolium*) as a good taxonomic species. This treatment is currently upheld by our recent observations of the plants growing at the type localities of *S. claviforme*, *S. laxissimum*, *S. rockefelleri* and *S. santolallae*, as well as by our observations of the living collections of these entities which have been grown under uniform field conditions at CIP. Additionally, it has now been determined by the writer that *S. claviforme* is conspecific with *S. laxissimum*, this on the basis of its similarity in habit, floral characteristics and leaf shape and dissection. It appears, therefore, as merely the most northerly-distributed population of this species. The remaining taxon mentioned above, *S. santolallae*, is restricted in distribution to the Province of Urubamba, Dept. of Cusco.

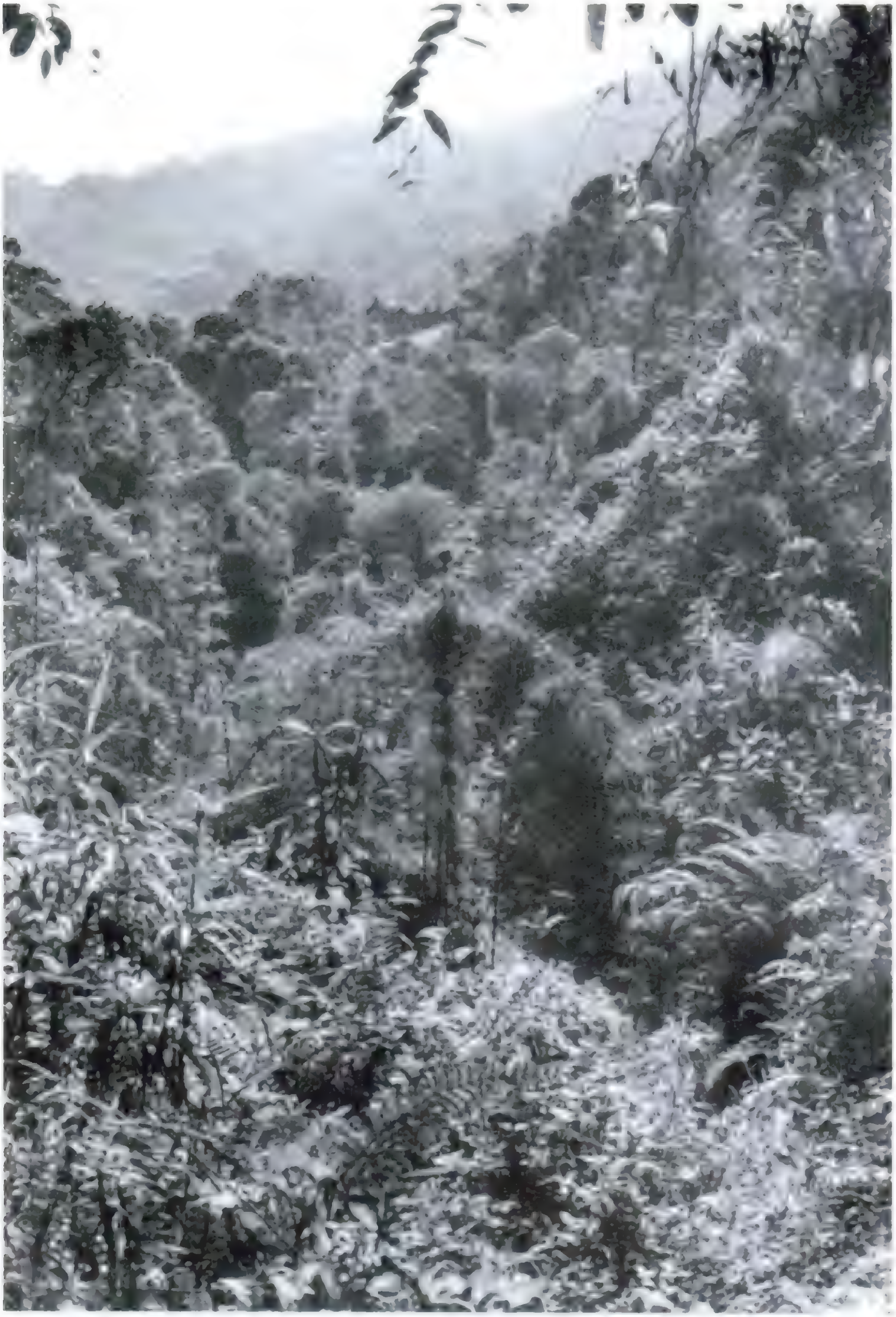


Figure 52. Habitat of *Solanum laxissimum* between Huanuco and Chinchao, near the top of the Carpish divide (1650 m alt.).

Affinities

Solanum laxissimum is related to *S. santolallae*. The two are similar in leaf shape and dissection, but differ with respect to corolla color and habit, with *S. laxissimum* being a much more vigorous plant than *S. santolallae*.

Habitat and Distribution

Solanum laxissimum is a member of the plant formation called *Ceja de Montaña*. This species grows among evergreen trees and shrubs in very rainy and moist regions or along the margins of densely wooded formations in the warm, temperate climate of the eastern slopes of the Andes. It is nearly always associated with trees of the genus *Cecropia* or with dense clumps of *Chusquea*, as well as with *Fuchsia*, *Calceolaria*, *Pteridium*, *Guadua* and various other grasses, composites, orchids and other non-tuberous species of *Solanum*. It is widely distributed, from 9°42' S and 76°4' W to 13°9' S and 72°31' W, extending through the Departments of Huánuco, Pasco, Junín, Ayacucho and Cusco, between 1800 and 3100 m altitude (see Map 5).

Specimens Examined

Department Ayacacho

Province La Mar: Mandingapampa, 3200 m alt., along the Tambo-Ayna road, April 1972, *C. Ochoa 3300* (OCH). Near Yanacocha, 3000-3200 m alt., across the Chacapunco River, in the *Ceja de Montaña*, foggy, among trees and shrubs, 12-30 February 1979, *C. Ochoa and A. Salas 13188* (CIP, GH, MO, MOL, OCH) and *13189*, 2n=24 (CIP, OCH).

Department Cusco

Province La Convención: Between San José and Alfamayo, 2500 m alt., heading down Panticalla Pass towards Huyro and Maranura, in the forested *Ceja de Montaña*, 9 March 1980, *C. Ochoa 13706*, 2n=24 (CIP, MO, MOL, OCH).

Province Paucartambo: Near Pillahuata, 2400 m alt., on hillsides and steep talus slopes, densely shrubby, on the Paucartambo-Kosñipata road, 6 April 1962, *C. Ochoa 2404* (OCH). Vicinity of La Esperanza, 2600 m alt., near Pillahuata, heading down the Paucartambo-Kosñipata road, among woody shrubs, 6 April 1962, *C. Ochoa 2405* (OCH). "Suecia" [Hacienda Suecia, without date or altitude], in open places, mountain slope, herb 0.60 m tall, *F. Woytkowski 168* (MOL).

Province Urubamba: Machu Pikchu, 2100 m alt., along forest edges, plants 160 cm tall, corolla purple, 4 January 1946, C. *Vargas C. 5548* (CUZ, LL-fragment, type collection of S. *rockefelleri*, OCH). Hills in the vicinity of the central station of the Machu Pikchu railroad, 1990 m alt., among woody shrubs, 22 February 1960, C. *Ochoa 2208* (OCH, CIP). Above the ruins of Wiñaywayna, 3000 m alt., in forests of the *Ceja de Montaña*, plants to 3 m tall, corolla dark-violet, 21 February 1980, C. *Ochoa 13640* (CIP, GH, MO, MOL, OCH). Baños de Aguas Calientes, 2200 m alt., near the central station of the Machu Pikchu railroad, on shrubby talus slopes, tubers ovoid or elongated, white, flowers iridescent-purple, 15-19 March 1980, C. *Ochoa 13785*, 2n=24 (CIP, GH, MO, MOL, OCH, US). Front of the hot baths of Aguas Calientes, 2140 m alt., near Machu Pikchu, among forest shrubs, plants more than 3 m tall, 23 March 1981, C. *Ochoa 14358* (CIP, GH, MO, MOL, OCH, US). Hot baths of Aguas Calientes, 2000 m alt., near the central station of the Machu Pikchu railroad, in very moist forests, March 1984, C. *Ochoa 15661* (CIP, MOL, MO, OCH).

Department Huánuco

Province Huamalíes: Near Mashuaragra, 2000 m alt., between Cerro Mirador and Aguellín, along the footpath from Tantamayo to Monzón, between shrubs, plants to 2 m tall, tubers ovoid, large, 7-10 cm long, 25 April 1967, C. *Ochoa 2642* (OCH) and (CIP, MO, MOL, OCH, from plants propagated at the Escuela Nacional de Agricultura, La Molina, Lima, October, 1967).

Province Huánuco: Between Huánuco and Pampayacu, east Andes, 13 January 1927, *K. Kanehira* 293 (GH). Vicinity of Piedras Grandes, 3000 m alt., forest reaching of grassland, moist sand path in sunny situations, flowers vivid purple, 6 November 1937, *F. Woytkowski 148* (F). Carpish, thicket, 2700 m alt., 7 August 1940, *E. Asplund 12818* (S). Carpish Divide, sub-shrub growing in the rain forest, 2750 m alt., October 1945, *C. Sandeman 5148* (K). Carpish, km 60 between Huánuco and Tingo Maria, plant to 1 m tall, corolla purple, 28 May 1946, *Charles Swingle* 66 (US). Carpish, 2700-2800 m alt., on the moutain summit between Huánuco and Tingo María, March 1947, *R.. Ferreyra 1942* (USM), and 9 August 1947, *R. Ferreyra 2389* (USM). Carpish Pass, 2800 m alt., on the Huánuco-Tingo María road, among abundant shrubby vegetation and herbs, very moist mountain, *n.v. Papa Cholon* or *Papa de Monte*, flowers dark violet, 17 March 1951, C. *Ochoa 1058* (OCH). Causejo, 2600 m alt., heading up Carpish Pass, near summit, between Huánuco and Tingo María, plants still very young, 18 April 1980, C. *Ochoa 13846*, 2n=24 (OCH, from plants propagated at Huancayo).

Department Junín

Province Chanchamayo [formerly Province Tarma]: Distr. La Merced, Cumbre Yacumay [Yacuhuanay], 2000 m alt., near summit, Chanchamayo Valley, above La Merced, flowers blue, 15 August 1957, *P.C. Hutchison 1181* (UC, US). Distr. La Merced, wooded slopes of Cerro Yacuhuanay, heading toward summit, 1700 m alt., near La Merced, Chanchamayo Valley, tubers ovoid, large, 10-12 cm long, 7 October 1987, *C. Ochoa and A. Salas s.n.* (CIP, MO, MOL, OCH).

Province Satipo [formerly Province. Jauja]: Valley of the Masamerich River, 3100 m alt., between the *tambos* of Atac and Calabaza, evergreen forest of composite trees and shrubs, 25 April 1913, *A. Weberbauer 6640* (F, GH, MOL, OCH, US, type collection of *S. laxissimum)*. Piedra Blanca, 3000 m alt., between Atac and Calabaza, Valley of the Masamerich River, along the forest margins, 31 March 1963, *C. Ochoa 2471* (topotypes CIP, GH, MO, MOL, OCH, US). Between Carrizal and Calabaza, 2700 m alt., near the banks of the Masamerich River, among forest trees and shrubs, 22 January 1978, *C. Ochoa 11855* (topotypes CIP, GH, MO, MOL, OCH, US). Nogaltambo, near Calabaza, 2500 m alt., April 1978, *C. Ochoa and A. Salas 12523* (OCH).

Province Tarma: Sarnapajcha, 2600 m alt., quebrada of the Vitoc River, Chanchamayo Valley, among forest shrubs, 28 January 1961, *C. Ochoa 2342* (CIP, GH, MO, MOL, OCH, US). At 3 km south of Marainioc, 3380 m alt., scarce, plants very young, on steep wooded talus slopes, among shrubs and herbs, *Siphocampilus*, *Monnina*, *Eupatorium*, *Oxalis*, *Lupinus*, *Buddleja*, 27 January 1979, *C. Ochoa 13126* (OCH).

Department Pasco

Province Oxapampa: Quebrada of San Alberto, 2200 m alt., west of Oxapampa, along forest margins and dense mounds of *Chusquea* sp., plants to 2 m tall with abundant bright purple flowers, corolla small, 2 cm in dia., 3 February 1979, *C. Ochoa 13158* (OCH). In the foothills of Cerro San Crispín, above Oyón, 2500 m alt., at the edge of forest, with *Cedrela*, *Inga*, *Juglans* and *Quercus* and shrubs such as *Calceolaria*, *Piper* and *Rubus* and many herbs such as *Bidens*, ferns and orchids, in mountain clearings (or *rozos de monte*), in very moist soils, tubers ovoid, large, to 10 cm long, compressed, 6 March 1996, *C. Ochoa and A. Salas 16255* (CIP, MOL, OCH, USM, UNTC). Canal de Piedra, about 25 km north of Villarica, 2200 m alt., along the borders of guayaba forests (*Psidium* sp.) and cultivated fields of coffee, 7 March 1996, *C. Ochoa and A. Salas 16256* (CIP, MOL, OCH, USM). Cumbre de Bocas, 2250 m alt., about 20 km in a straight line north-northeast of Villarica, inside fields of *rocoto* (*Capsicum pubescens*), fruits long-conical with a pointed apex, light green, 2.5 cm long, 8 March 1996, *C. Ochoa and A. Salas 16257* (CIP, MOL, OCH, USM).

Province Pasco: Near Junín-Huacanán, 2600 m alt., via Paucartambo, about 20 km east of Yungul, extension of Yaupe, 19 March 1968, C. *Ochoa 2677* (CIP, GH, MO, MOL, OCH, US).

Table 11. Fertility of *Solanum laxissimum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	PIURANA	× *S. humectophilum*	33	22	30
24	2	CONICIBACCATA	× *S. buesii*	46(55)	10(40)	20(113)
			× *S. chomatophilum*	36(68)	22(19)	5(84)
			× *S. limbaniense*	35(20)	26(19)	72(133)
			× *S. rhombilanceolatum*	24(56)	19(26)	2(55)
			× *S. santolallae*	11(13)	11(13)	162(178)
			× *S. urubambae*	13(164)	6(73)	35(4)
24	2	TUBEROSA	× *S. bukasovii*	26(53)	11(31)	126(67)
			× *S. coelestispetalum*	16(24)	9(24)	44(92)
			× *S. goniocalyx*	27(25)	9(11)	91(61)
			× *S. marinasense*	16(21)	12(10)	250(39)
			× *S. stenotomum*	5(5)	0(4)	0(90)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

The great majority of the living collections of *S. laxissimum* that were examined for this study turned out to be self-incompatible. Only rarely was self-compatibility encountered.

It was early recognized in working with *S. laxissium* that this species could be very easily crossed with many species, and especially those which belong to other series. Thus, compatibility was found in the unilateral cross with *S. humectophilum* (2n=24 and EBN=1) of the series Piurana, as well as in plants resulting from reciprocal crosses with *S. bukasovii*, *S. coelestispetalum*, *S. goniocalyx* and *S. marinasense*, all Series Tuberosa and with 2n=24 and EBN=2. However, reciprocal crosses with *S. stenotomum* were only partially compatible, and success was obtained only in cases where *S. laxissimum* was used as a male parent. Not surprisingly, compatibility was also obtained in reciprocal crosses with other species of Conicibaccata having 2n=24 and EBN=2, such as *S. buesii*, *S. chomatophilum*, *S. limbaniense*, *S. rhombilanceolatum* and *S. santolallae*. Nevertheless, in crosses involving *S. urubambae*, a species known to grow sympatrically with *S. laxissimum* and S. *santolallae*, berries with fertile seeds were obtained only when *S. laxissimum* was used as a female parent.

The results of these crosses are reported in Table 11, while the materials used for the experiments are shown in Table 12.

Table 12. Collections (OCH) used in *Solanum laxissimum* fertility studies.

CONICIBACCATA
S. buesii 13629
S. chomatophilum 11281, 11753A, 13010, 13205, 13206, 13307, 13325
S. laxissimum 11855, 12593, 13188 13189, 13640, 13706, 13785
S. limbaniense 14288, 14290, 14405
S. rhombilanceolatum 11869, 13111, 14406
S. santolallae 13628
S. urubambae 13778, 13779, 13779A, 13781

PIURANA
S. humectophilum 11753, 13247

TUBEROSA
S. bukasovii 5106, 7953, 11786, 11859 11875, 13121, 13124, 13168, 13558, 13715
S. coelestispetalum 13597, 13609, 13632, 13687, 13801
S. goniocalyx 00001, 464-85
S. marinasense 13722, 13748, 13809
S. stenotomum 527-85, 691-85A

11. *Solanum limbaniense* Ochoa, Bol. Soc. Peruana de Bot. 7(1-2):14, 15-19, illustr., 1974. Figs. 53-58; Map 6.

Plant erect or laxly ascending, (10-)20-40(-50) cm tall, glabrous or subglabrous; stem simple or little branched, straight or slightly flexed, 3-5(-8) mm in dia. at base, internodes (0.5-1.0-)2.0-5.0(-8.0) cm long, slightly pigmented or light green and speckled deep violet only in the basal two-thirds of its length and in the leaf axils, wingless or inconspicuously very narrowly winged. Stolons

25-30(-50) cm long, slender, 1.0-1.5 mm in dia.; tubers ovoid to elongate pyriform or long subcylindrical (Fig. 56), 1.5-4.0 cm long, white or white diffused with pale rose toward the apex with semi-deep to superficial eyes, budding periodically, flesh white. Leaves imparipinnate, very rarely simple, with (0-)1-2(-3) pairs of lateral leaflets, (3.0-)7.0-17.5(-27.0) cm long including the petiole by (2.0-)5.5-12.5(-16.0) cm broad, without interjected leaflets, dark green and glabrous or glabrescent above, lighter green and less pilose along the lower veins and veinlets, hairs very short and sparse; petiolules long, 5-7 mm or more in length. Terminal leaflet larger than the laterals, (2.5-)4.5-8.0(-9.5) cm long by (1.7-)2.6-3.5(-4.5) cm broad, ovate or broadly ovate-lanceolate, the apex pointed

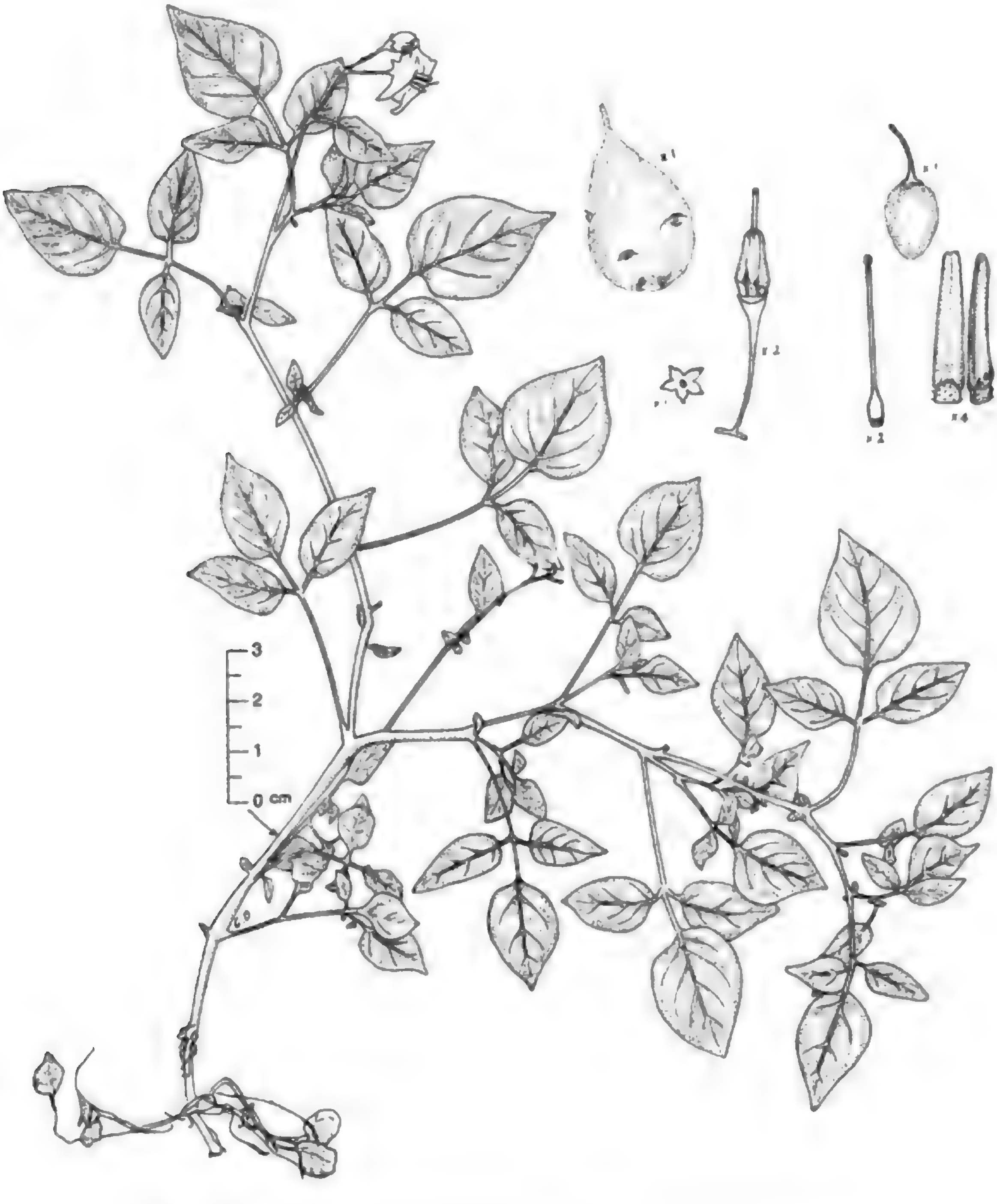


Figure 53. *Solanum limbaniense* (*Ochoa 5165*, holotype).

and the base broadly rounded to subcordate; lateral leaflets elliptic, the apex subpointed to obtuse and the base obtuse to obliquely rounded, shortly petiolulate; petiolules 1.5-3.5 mm long, the leaflets of the first upper pair (1.5-)3.5-7.0(-8.5) cm long by (1.0-)2.0-3.0(-3.5) cm broad. Pseudostipular leaves narrowly obliquely elliptic-lanceolate, the apex subpointed to obtuse, 18 mm long by 8 mm broad. Inflorescence a terminal or lateral cyme 1-4(-8)-flowered; peduncle 5-9 cm long, slender, 1.5 mm in dia., slightly pigmented, glabrous like the pedicels and calyx; pedicels short 15-20 mm long, strongly pigmented like the calyx, articulated below center or near center, usually about 8-11 mm below base of calyx, rarely in the upper one-third of its length. Calyx asymmetrical, small, 5.5 cm long; lobes short and broadly elliptic-lanceolate to ovate-lanceolate, shortly acuminate or apiculate. Corolla purple or lilac, 2.5(-3.0) cm in dia., rotate, with abruptly and prominently narrowed acumens (Fig. 54), externally whitish and with very short lobes. Staminal column cylindrical-conical; the anthers narrowly lanceolate 5-6 mm long on filaments 1-2 mm long, sparsely pubescent. Style up to 11 mm long, usually 8-9 mm long, exerted 3.5-4.0 mm, sparsely papillose on the basal one-third of its length; stigma oval-claviform, cleft. Fruit long-conical, the apex subobtuse or pointed, pale green, 2 cm long by 1.4 cm in dia. at base. Chromosome Number: $2n=24$. EBN=2.

Local name: *Puyuli* in Limbani and Cullucachi, Department of Puno.

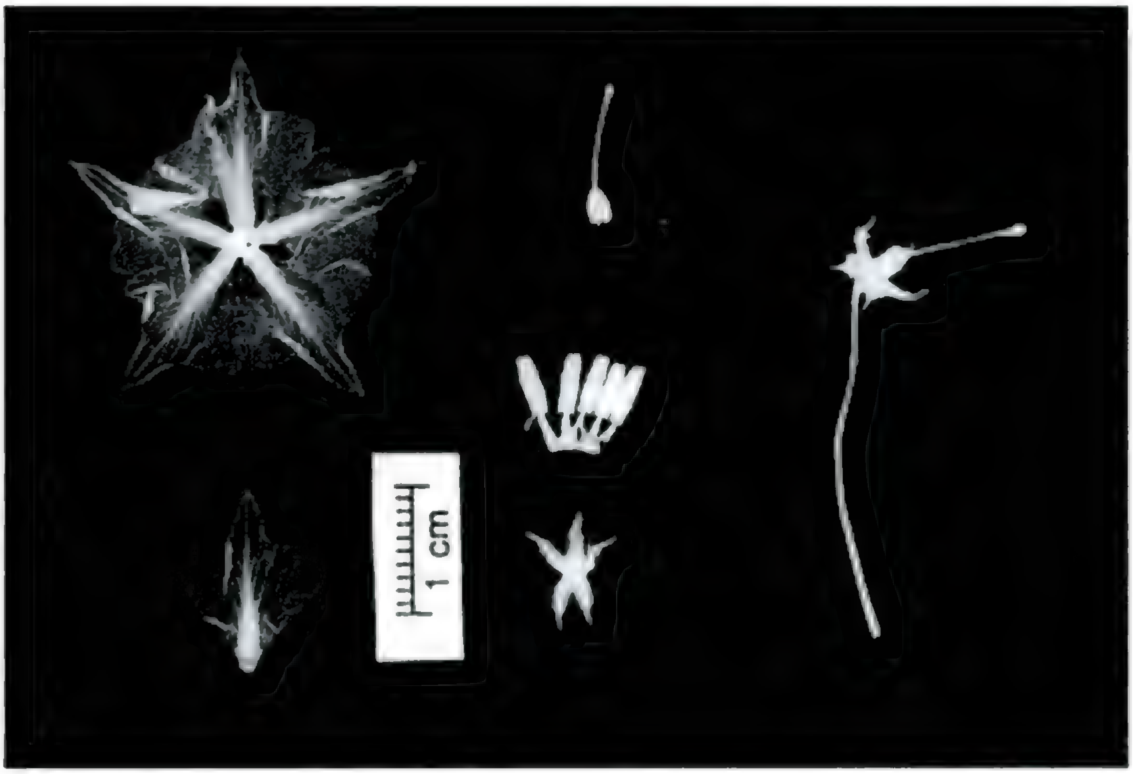


Figure 54. Floral dissection of *Solanum limbaniense* (*Ochoa 5165*, holotype).

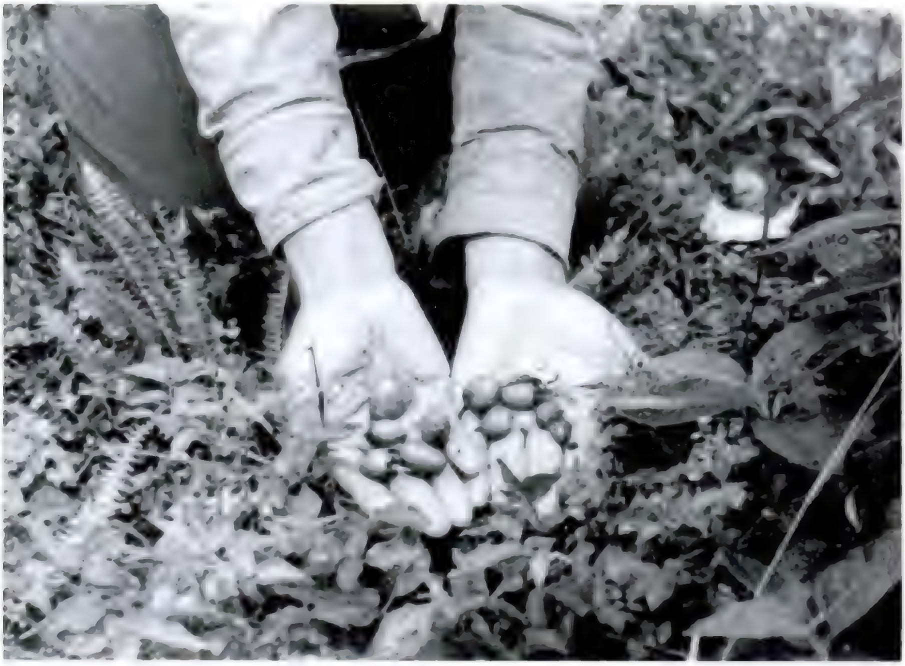


Figure 55. *Solanum limbaniense* in its habitat at Palca, Puno (*Ochoa 14290*).

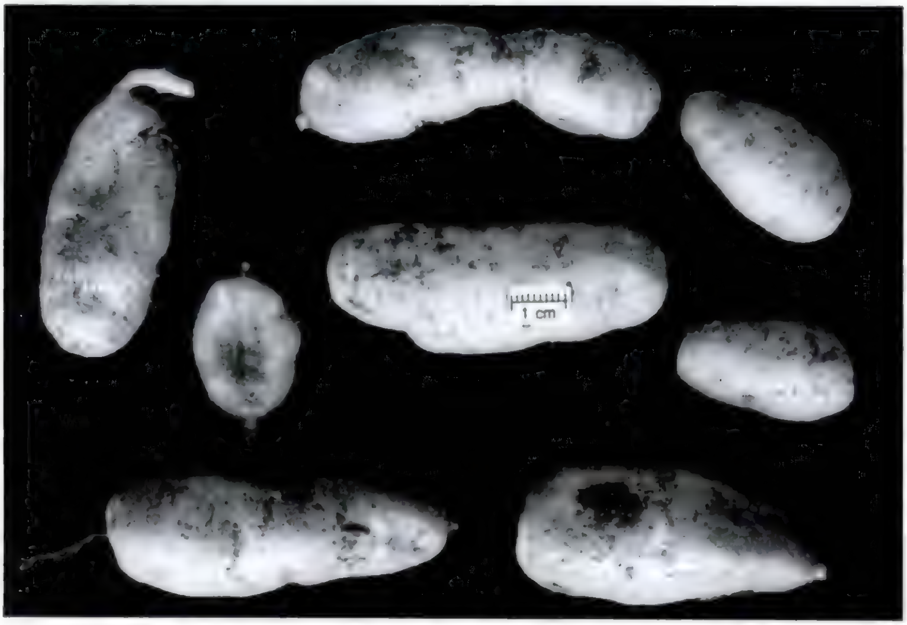


Figure 56. Tubers of *Solanum limbaniense* collected at Palca (3400 m alt.), Puno (*Ochoa 14290*).

naterial

Type: PERU. Department Puno, Province Sandia, Cullucachi, 3520 m alt., in the highlands of Phara-Limbani, April 1974, *C. Ochoa 5165* (holotype OCH, isotypes CIP, LE, MO, MOL, OCH).

Morphologically, this plant is close to *S. phureja* and may possibly represent one of the near ancestors of this cultigen. The two have similar leaves, flowers and calyces, and both produce tubers that can sprout almost immediately after harvesting or only after a very short period of dormancy.

The appearance of this species varies from one ecological zone to the next. Thus, at the type locality of this species, Cullucachi (alt. 3520 m), the habitat consists of a very moist, open and gently sloping *puna* formation. At this locality the plants are very small or dwarfed, no more than 8-10 cm tall, and have, commonly, simple leaves or ones which bear but 1 or 2 pairs of sessile lateral leaflets. On the other hand, the populations of this species that are encountered above Angosto Ranra, a deep, narrow and very moist quebrada vegetated by mountain shrubs and thickets despite its great elevation (alt. 3720 m), consist of very well developed and much more vigorous plants, 40-50 cm tall, with much larger imparipinnate leaves bearing up to 3 pairs of leaflets on petiolules that are up to 3 mm long.

Similarly, collections from Palca (*Ochoa 14290*), although incorporating some minor characteristics that are not represented in the type collection of *S.*

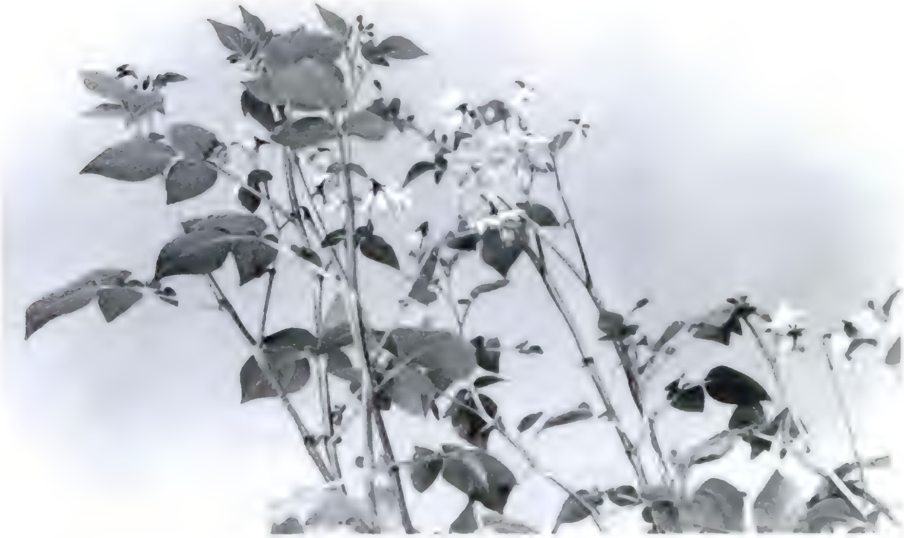


Figure 57. Living plants of *Solanum limbaniense* in full flower.

limbaniense, such as a deeper purple-colored corolla having an internal gray-violet star, leaves that are more dissected and sparsely pilose and larger tubers (according to our observations on greenhouse plants), basically belong to this species.

Affinities

Solanum limbaniense is closely related to *S. pillahuatense*. Both have poorly dissected leaves that are borne on long petioles, and both lack interjected leaflets. However, the two differ with respect to the degree of their hairiness. In *S. limbaniense*, the entire plant including the leaves are glabrous or subglabrous, while in *S. pillahuatense* the plants are essentially pubescent. Moreover, in *S. limbaniense*, the plants are low in stature or even dwarfed, while in *S. pillahuatense* they are usually taller in stature and never dwarfed. *Solanum pillahuatense* also differs from *S. limbaniense* in having a rotate-pentagonal corolla (rather than one which is simply rotate) and much narrower corolla lobes.

Habitat and Distribution

The main habitat of this species is on gentle slopes in open fields of *puna* or *prepuna*, where it may be associated with *Barnadesia pycnophylla*, *Festuca*, *Gentiana ignea* and *Stipa*. However, it has also been collected on old stone or earthen walls (Fig. 58), as well as in some very deep and narrow quebradas. In the latter areas it grows on very moist and very steep slopes covered with a residual (or relic) thicket formation which is transitional between *puna* and *Ceja de Montaña* and which is characterized by such plant genera as *Begonia*, *Calceolaria*, *Lupinus*, *Oxalis*, *Physalis*, *Poa*, *Stipa* and *Urtica*. Here also occur some examples of the splendid species *Salvia dombeyii*, as well as many herbaceous ferns and melastomes.

Although *S. limbaniense* is most frequently encountered in the highest grassland regions of the mountains, or *puna*, as for example at Cullucahi and Angosto Ranra, between Limbani and Aricoma Pass (3400-3750 m), it is one of the few tuberous species of Conicibaccata that also habituates the lower reaches of the *puna* all the way down to the *Ceja de Montaña* where the climatic conditions are much more benign, although marked by considerably more rain, humidity and cloudiness, as suggested by the native name for this species, *Puyuli*.

Solanum limbaniense is presently known only from the Province of Sandia in the Department of Puno in southeastern Peru, where it occurs most frequently at elevations between 2900 and 3750 m, although the total altitudinal range for this species extends from 3500 to 3700 m (Map 6).

Specimens Examined

Department Puno

Province Sandia: About 4 km by foot northeast of Sina, *ca*. 3350 m alt., in the unilateral ion of the Chintapampa River, among stones and woody shrubs, March 1973, C. *Ochoa 4201*, 2n=24 (CIP, MO, MOL, OCH, UNTC, USM). Near La Apacheta de Totora, 3600 m alt., along the Sequi-Totora-Pablobamba bridle trail, in grasslands, plants very small, in flower 5-7 cm tall, March 1973, C. *Ochoa 4211* (MOL, OCH). Heading down the bridle trail from the *punas* of Totora toward the *ceja de monte* in the unilateral ion of Pablobamba, 3400 m alt., among forest shrubs, March 1973, *C. Ochoa 4212* (CIP, MO, MOL OCH, US). Cullucachi, 3520 m alt., near Limbani-Phara, in puna grasslands or on old stone or earthen walls, n.v. *Puyuli*, associated with *Cajophora*, *Oxalis*, *Poa*, *Stipa* and *Urtica*, 6 April 1974, *C. Ochoa 5165*, 2n=24 (CIP, LE, MO, MOL, OCH, type collection of *S. limbaniense*). Mountains of Pucoata, 3400 m alt., on steep hillsides near Phara among woody shrubs or along forest margins, 6 April 1974, C. *Ochoa 5169* (CIP, MOL, OCH, USM). Above Angosto Ranra, 3750 m alt., heading up the road from Limbani to Aricoma Pass at 4815 m, stony slopes, with *Gentiana and Lupinus,* beneath shrubs of *Barnadesia,* 6 April 1974, C. *Ochoa 5201*, 2n=24 (CIP, GH, MO, MOL, OCH, UNTC, USM, US). Cullucachi, 3540 m alt., not abundant, between old stone and earthen walls, berries long-conical, 10 March 1981, C. *Ochoa 14288* (CIP, MOL, OCH, UNTC, USM, topotypes of *S. limbaniense*). Cullucachi, 3500 m alt., near Phara, in *puna* on a stony hillside with large tufts of *Stipa ichu,* flowers very dark purple with an almost black internal star, 3 March 1981, C. *Ochoa 14289*, 2n=24 (OCH, topotype de S. *limbaniense*). Near Palca, 3300-3450 m alt., about 10 km west of Phara in the *Ceja de Montaña*, among hedges and woody shrubs associated with ferns, mosses and various grasses, 3 March 1981, C. *Ochoa 14290*, 2n=24 (OCH) and (CIP, MOL, OCH, USM, from plants propagated at Huancayo), *14291*, 2n=24 (CIP, OCH), *14292*, 2n=24 (CIP, MOL, OCH, UNTC, USM), and *14293*, 2n=24 (CIP, MOL, OCH, USM). On the left bank of the Phara River, 2900 m alt., following the bridle trail from Phara to Limbani, only 4 berries were collected, 31 March 1981, C. *Ochoa 14405*, 2n=24 (CIP, OCH, USM, from plants propagated at Huancayo). Pharachaqui, 3000 m alt., following the bridle trail by foot from Patambuco to Phara, among forest shrubs of a moist and temperate climate, 19 February 1983, C. *Ochoa and A. Salas 15079* (CIP, MOL, OCH). Near Cullucachi, 3500 m alt., traveling by foot from Phara to Patambuco, among old enclosures and walls of stone and earth, in very moist soils, fruits long-conical, 5 March 1984, C. *Ochoa and A. Salas 15601*, 2n=24 (CIP, GH, MO, MOL, OCH, UNTC, USM, US, topotypes of *S. limbaniense*).

Table 13. Fertility of *Solanum limbaniense* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	CIRCAEIFOLIA	× *S. circaeifolium* var. *capcissibaccatum*	36(6)	28(5)	21(0)
24	1	LIGNICAULIA	× *S. lignicaule*	14(9)	14(0)	0(0)
24	1	MEGISTACROLOBA	× *S. dolichocremastrum*	6	3	0
24	1	PIURANA	× *S. humectophilum*	5	4	125
24	1	TUBEROSA	× *S. immite*	12(4)	8(4)	0(0)
24	2	CONICIBACCATA	× *S. chomatophilum*	12(13)	11(6)	2(42)
			× *S. laxissimum*	20(35)	19(26)	133(72)
			× *S. rhombilanceolatum*	14(10)	14(10)	112(290)
			× *S. urubambae*	6	4	38
			× *S. violaceimarmoratum*	22(21)	20(20)	88(86)
24	2	MEGISTACROLOBA	× *S. boliviense*	7	3	70
			× *S. raphanifolium*	36(4)	24(1)	57(11)
24	2	TUBEROSA	× *S. bukasovii*	7(8)	4(3)	29(150)
			× *S. candolleanum*	33(30)	18(21)	91(91)
			× *S. goniocalyx*	3(5)	3(4)	123(88)
			× *S. leptophyes*	7(5)	5(4)	51(231)
			× *S. medians-2x*	8	5	34
			× *S. multiinterruptum*	12(7)	6(2)	0(0)
			× *S. phureja*	10	7	76
			× *S. stenotomum*	8	6	162
24	2	YUNGASENSA	× *S. yungasense*	12	10	22
48	4	TUBEROSA	× *S. tuberosum* subsp. *andigena*	10	9	0

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

The results of the experimental crossing program involving *S. limbaniense* are given in Table 13, while the materials used for these crosses are shown in Table 14.

The reciprocal crosses of *S. limbaniense* (2n=24 and EBN=2) with *S. circaeifolium* var. *capsicibaccatum* of the series Circaeifolia were partially compatible. Berries containing the normal average number of seeds were obtained only when this variety of *S. circaeifolium* was used as the male parent. Greater success, however, was obtained in unilateral crosses involving *S. humectophilum* of the series Piurana. These crosses resulted in a high average number of fertile seeds. Complete incompatibility was observed in reciprocal crosses involving *S. immite* and *S. lignicale* and in the unilateral cross of *S. dolichocremastrum*.

As expected, totally compatible results were obtained in reciprocal crosses of this species with *S. goniocalyx*, *S. candolleanum*, *S. raphanifolium*, *S. leptophyes* and *S. bukasovii*, all of series Tuberosa, and *S. chomatophilum*, *S. laxissimum*, *S. rhombilanceolatum* and *S. violaceimarmoratum*, all of series Conicibaccata. Similarly, success was enjoyed in unilateral crosses of this species with *S. medians*-2x, *S. phureja* and *S. stenotomum* of series Tuberosa and *S. urubambae* of series Conicibaccata. The results obtained from reciprocal crosses with *S. multiinterruptum* and the subspecies *andigena* of the series Tuberosa, however, were disappointing.

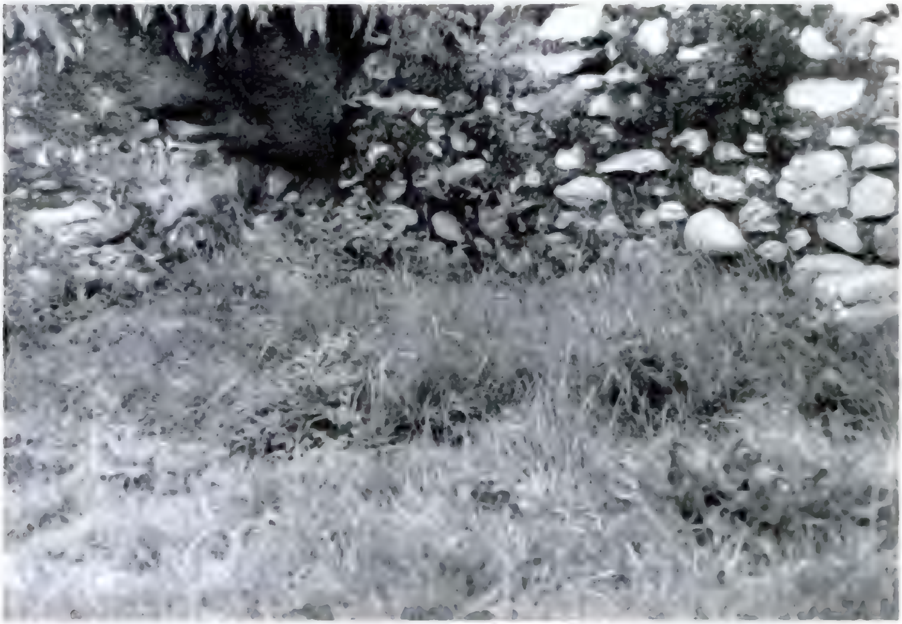


Figure 58. Type locality of *Solanum limbaniense* at Cullucachi (3500 m), about 5 km south of Phara. The plants, photographed on March 5, 1984, are growing on an old rock border in full flower.

Table 14. Collections (OCH) used in *Solanum limbaniense* fertility studies.

CIRCAEIFOLIA
S. circaeifolium var. *capsicibaccatum* 1730

CONICIBACCATA
S. chomatophilum 11046, 13196, 13206
S. laxissimum 11855, 13188, 13640
S. limbaniense 5201, 14288, 14290, 14291, 14292, 14293, 14405, 15079
S. rhombilanceolatum 11869
S. urubambae 13781
S. violaceimarmoratum 11901

LIGNICAULIA
S. lignicaule 11317, 11617

MEGISTACROLOBA
S. boliviense 11935
S. dolichocremastrum 12072
S. raphanifolium 8333, 13775, 14296

PIURANA
S. humectophilum 13247

TUBEROSA
S. bukasovii 9795, 13559
S. candolleanum 11805, 11896, 14959, 14990, 15002
S. goniocalyx 00001, 562-85
S. immite 13346
S. leptophyes 13733
S. medians-2x 11638
S. multiinterruptum 11696, 12057, 12057A
S. phureja 15069
S. stenotomum cv. Yuca
S. tuberosum subsp. *andigena* 15033

YUNGASENSA
S. yungasense-2x 15041.

12. *Solanum nemorosum* Ochoa, Am. Potato J. 60(6):389-392, 1983.

Figs. 59-60; Map 7.

Plant very vigorous, lax-erect or erect-ascending, 120-150 cm or more tall, sparsely pilose. Stem subglabrous, simple or branched, 2 cm in dia. at base, pigmented or only slightly so toward the basal one-third of its length and in the leaf axils, sparsely flecked with light green toward the upper one-third of its length, conspicuously straight-winged, light green, the margins subdentate; internodes (3.5-)5.0-8.0 cm long; stolons 1 m or more long; tubers ovoid or elongated subcylindrical, white, 4-5 cm long. Leaves imparipinnate, long, including the petiole (22-)27-31(-37) cm in length by (12.5)-16.5-18.0(-21.0) cm broad, somewhat rugose and vernicose, dark green, sparsely pilose including the rachis and the petiole; upper leaf surface light green, lower leaf surface opaque and somewhat less pilose, with 4-5(-6) pairs of lateral leaflets and 5-8(-12) pairs of interjected leaflets; petioles long, 3.5-5.0(-6.5) cm in length. Terminal leaflet slightly larger than the lateral leaflets, (7-)8-10 cm long by (3.3-)4.0-5.5 cm broad, broadly elliptic-lanceolate, the apex pointed to shortly acuminate and the base rounded; the first pair of lateral leaflets (5.5-) 7.0-9.0 cm long by (2.5-)3.0-4.0 cm broad, elliptic-lanceolate as in the case of the remaining lateral leaflets, the apex pointed to subacuminate and the base obliquely rounded, on petiolules 2-5 mm long, rarely sustaining an acroscopic or basiscopic interjected leaflet. Interjected leaflets orbicular, ovate or elliptic, sessile, of various size, the smaller 1.5-2.5 mm long, whereas the larger are 18 mm long by 12 mm broad. Pseudostipular leaves broadly falcate or asymmetrically elliptic-lanceolate to ovate-lanceolate, long, 12-16(-20) mm in length by 6-10(-12) mm broad. Inflorescence cymose-paniculate, 6-10-flowered. Peduncle 12-15 cm long by 2.5 mm in dia. at base, glabrous or subglabrous, lighter green in the basal two-thirds of its length and slightly pigmented in the upper one-third of its length, as in the case of pedicels and calyx; pedicels short, 20-25 mm long, very shortly and sparsely pilose like the calyx; articulated in the upper third of their length or slightly above center, usually 7-9 mm below the calyx. Calyx symmetrical, 7.5-9.0 mm long; lobes 2-3 mm long, narrowly elliptic-lanceolate, gradually narrowed to the pointed acumens. Corolla rotate, small, 2.5 cm in dia., light blue with a broad white border in the form of a star that extends from the base of the petals toward the acumens (Fig. 60). Anthers narrowly lanceolate 5.5 mm long, base cordate; filaments 1.0-1.5 mm long, white-hyaline, glabrous. Style 8.0-8.5 mm long, exerted 2.5 mm, pap-

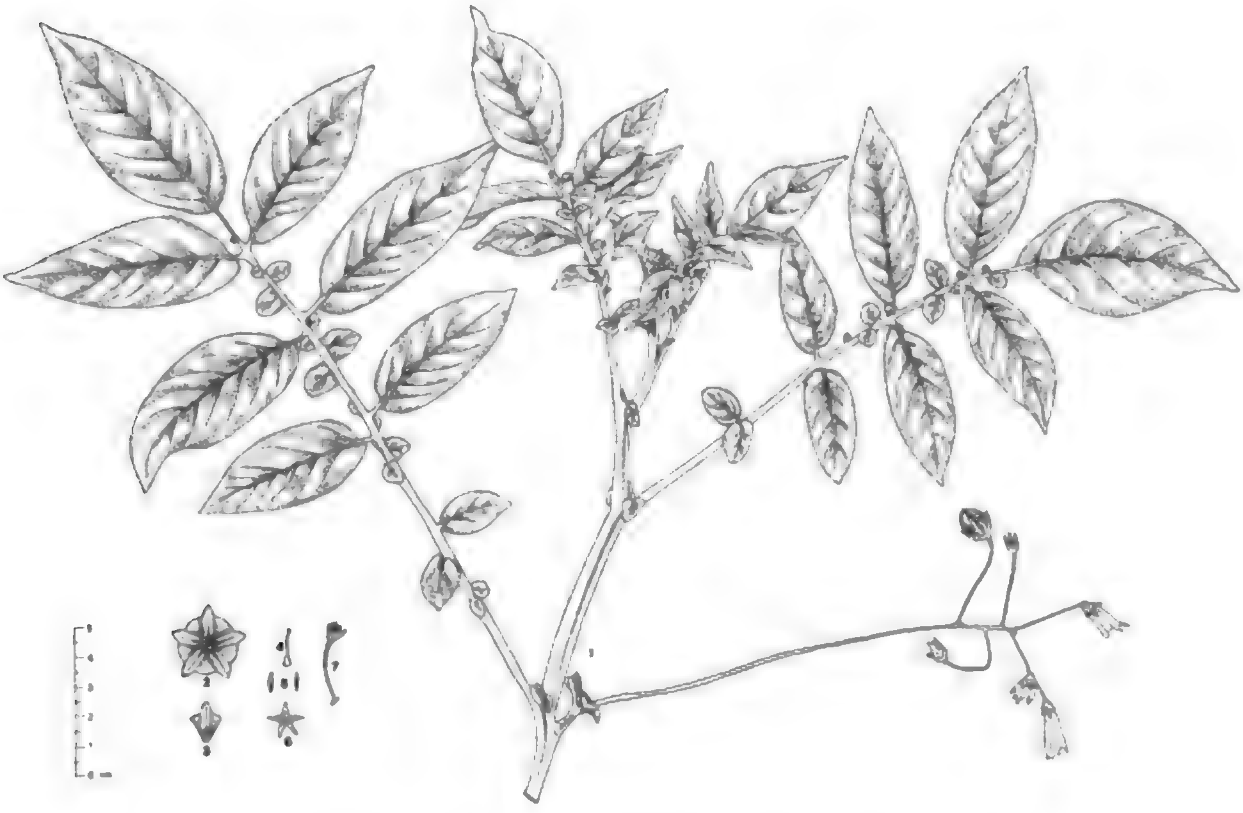


Figure 59. *Solanum nemorosum* (*Ochoa and Salas 14809*, holotype).

illose below midpoint; stigma oval-claviform. Fruit long-conical, the apex pointed, 20 mm long by 12-13 mm in dia. at base, uniformly light green. Chromosome number: 2n=72. EBN=4.

Type: PERU. Department Cajamarca, Province San Ignacio, between Tabaconas and Riachuelo Shumaya, 2800 m alt., May 1982, *C. Ochoa 14809* (holotype OCH, isotypes CIP, MOL, UNTC, US).

Affinities

Solanum nemorosum is related to *S. jaenense* by the small size of its corolla and the shape of its leaflets. Moreover, both species are hexaploids (2n=72). However, they differ notably in the habit and vigor of the plant, as well as by the texture, color and dissection of the leaves. The above two species are also similar in some respects to *S. tundalomense* and *S. colombianum*, two Ecuadorian-Colombian species that characteristically also have very small rotate corollas.

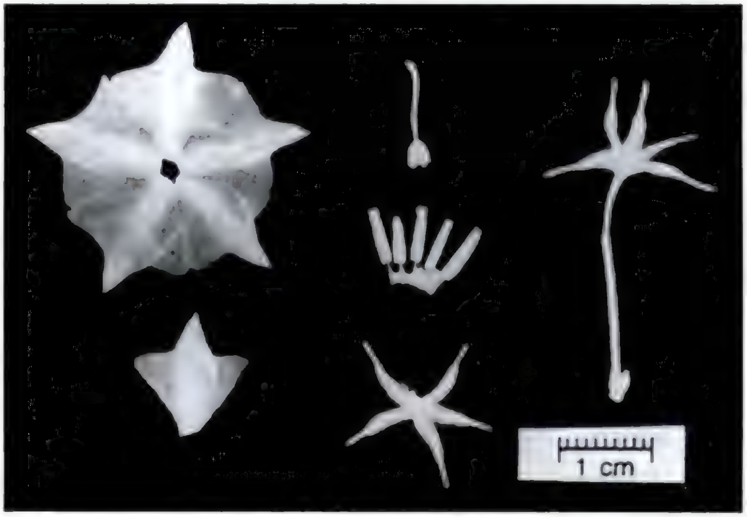


Figure 60. Floral dissection of *Solanum nemorosum* (*Ochoa and Salas 14809*, holotype).

Habitat and Distribution

Solanum nemorosum grows among virgin forest trees and shrubs, near the banks of small streams, in moist, organically rich soils, at altitudes near 2800 m. The distribution of this species is very restricted, and is known today only from its type locality (Map 7).

Specimen Examined

Department Cajamarca

Province San Ignacio: District Tabaconas, between Tabaconas and Riachuelo Shumaya, 2800 m alt., near Granadilla, among virgin forest trees and shrubs, plants very robust, corolla pale blue with a white star, 23 May 1982, *C. Ochoa and A. Salas 14809*, 2n=72 (CIP, MOL, OCH, UNTC, US, type collection of *S. nemorosum*).

Breeding Potential

Reciprocal crosses of *S. nemorosum* with *S. chomatophilum* (2n=24 and EBN=2) and *S. albicans* (2n=72 and EBN=4) were unsuccessful. Similarly, unilateral crosses of *S. nemorosum* with *S. chiquidenum*, *S. huancabambense* and *S. paucissectum* (all 2n=24 and EBN=2) yielded no berries.

13. *Solanum neovargasii* Ochoa, in Ochoa, *Los Solanum Tuberíferos Silvestres del Perú*, Lima, 53-57, illustr., 1962.

Figs. 61-62; Map 5.

Plant robust, erect-ascending, 2 m tall. Stem simple or branched 1.5 cm in dia. at base, narrowly straight-winged, lightly pigmented toward base, the upper part light green; internodes 5-12 cm long, subglabrous or very short and sparsely pilose in the terminal one-third of its length. Stolons 20-35(-40) cm long; tubers long to very elongated, small, 2.5-4.0 cm long, white. Leaves imparipinnate with (2-)3-4(-5) pairs of leaflets and 2-4(-8) pairs of interjected leaflets, pilose, especially on the leaf margins, rachis and upper side of the petioles, hairs very short, white or straw-colored, somewhat more densely pilose on the veins and veinlets below, interjected leaflets large, 20 mm long by 15 mm broad, shortly petiolulate, with an obtuse apex. Leaves 25.0-30.0(-41.5) cm long by (7.0-)15.0-21.0(-22.5) cm broad; leaflets elliptic-lanceolate, the apex pointed or long acuminate and the base obliquely cuneate to obliquely rounded, on petiolules 2-4 mm long; rachis, petioles, petiolules and leaflets of the upper leaves very pilose, hairs very short,

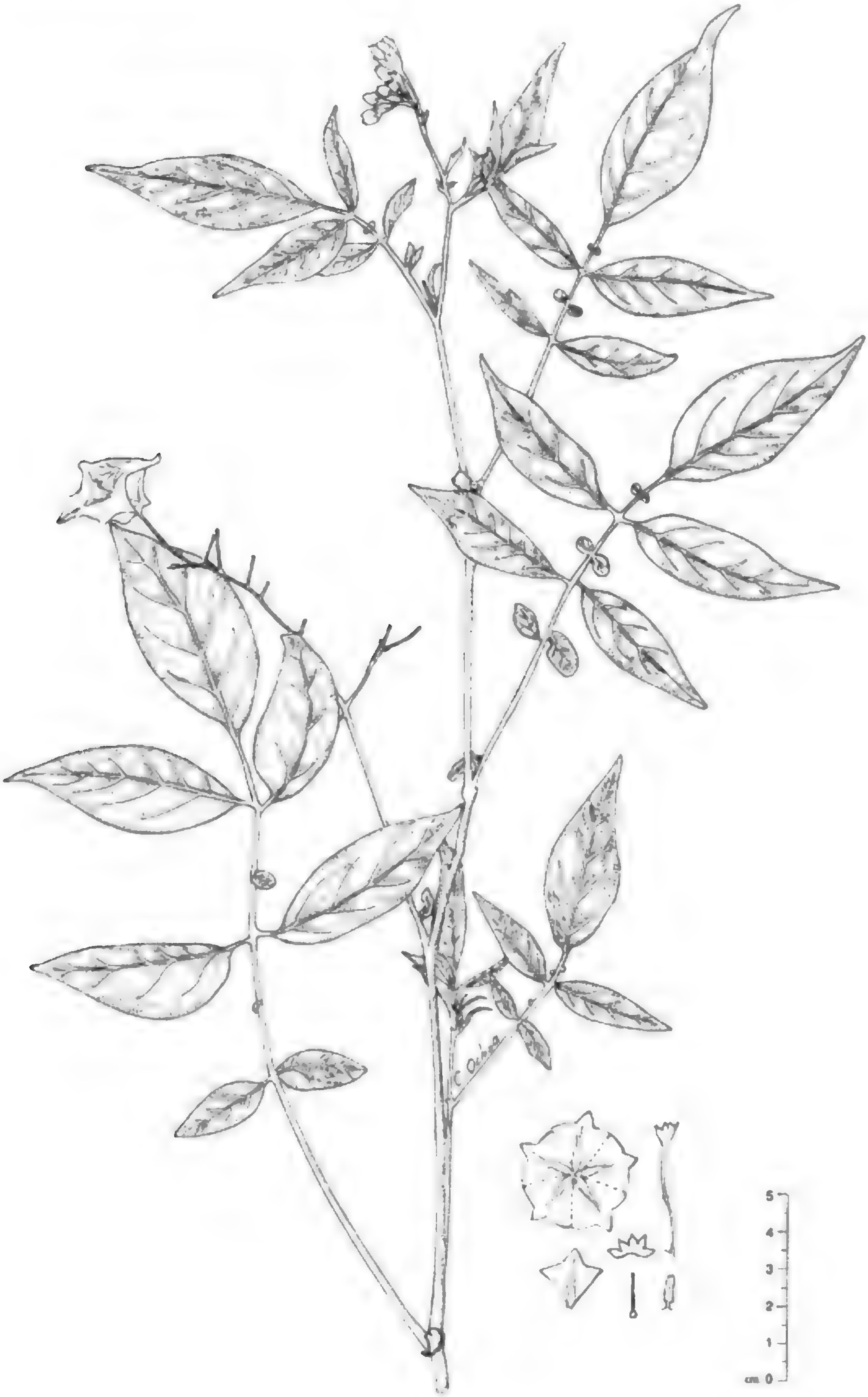


Figure 61. *Solanum neovargasii* (*Ochoa 2343*, holotype).

more yellowish, brilliant and dense above. Terminal leaflet broadly ovate-lanceolate to broadly elliptic-lanceolate and somewhat larger than the first pair of laterals, (5.5.-)7.5-10.5(-13.5) cm long by (2.0-)3.0-5.0(-5.5) cm broad; first pair of leaflets (2.5-)7.0-9.5(-10.5) cm long by (1.0-) 2.8-3.5(-4.0) cm broad. Pseudostipular leaves broadly falcate, the apex pointed, 12 mm long. Inflorescence terminal or lateral, cymose to cymose-paniculate, 10-18-flowered, rarely with up to 40 flowers. Peduncle vigorous, 9 cm long by 2.5 mm in dia. at base, forked one or more times, pubescent as in the case of pedicels; pedicels 25-30 mm long, articulated at midpoint or slightly above center. Calyx symmetrical, 6 mm long, lightly pigmented, glabrous, lobes short, ovate-lanceolate, the apex apiculate, margins narrowly membranous, very shortly pilose toward the apex. Corolla rotate, purple, 3.0-3.5 cm in dia., with very short lobes and short acumens, puberulent at apex and broadly triangular (Fig. 61). Staminal column cylindrical-conical, symmetrical; anthers lanceolate 6 mm long, pale yellow, base cordate; filaments 1 mm long, pubescent with transparent, pointed and multicellular hairs. Style 12 mm long, exerted 3.0-3.5 mm, sparsely and shortly papillose in the lower one-third of its length; stigma subcapitate, small, slightly enlarging at apex. Fruit long ovoid to ellipsoid, the apex obtuse, light green, 2 cm long. Chromosome Number: 2n=24.

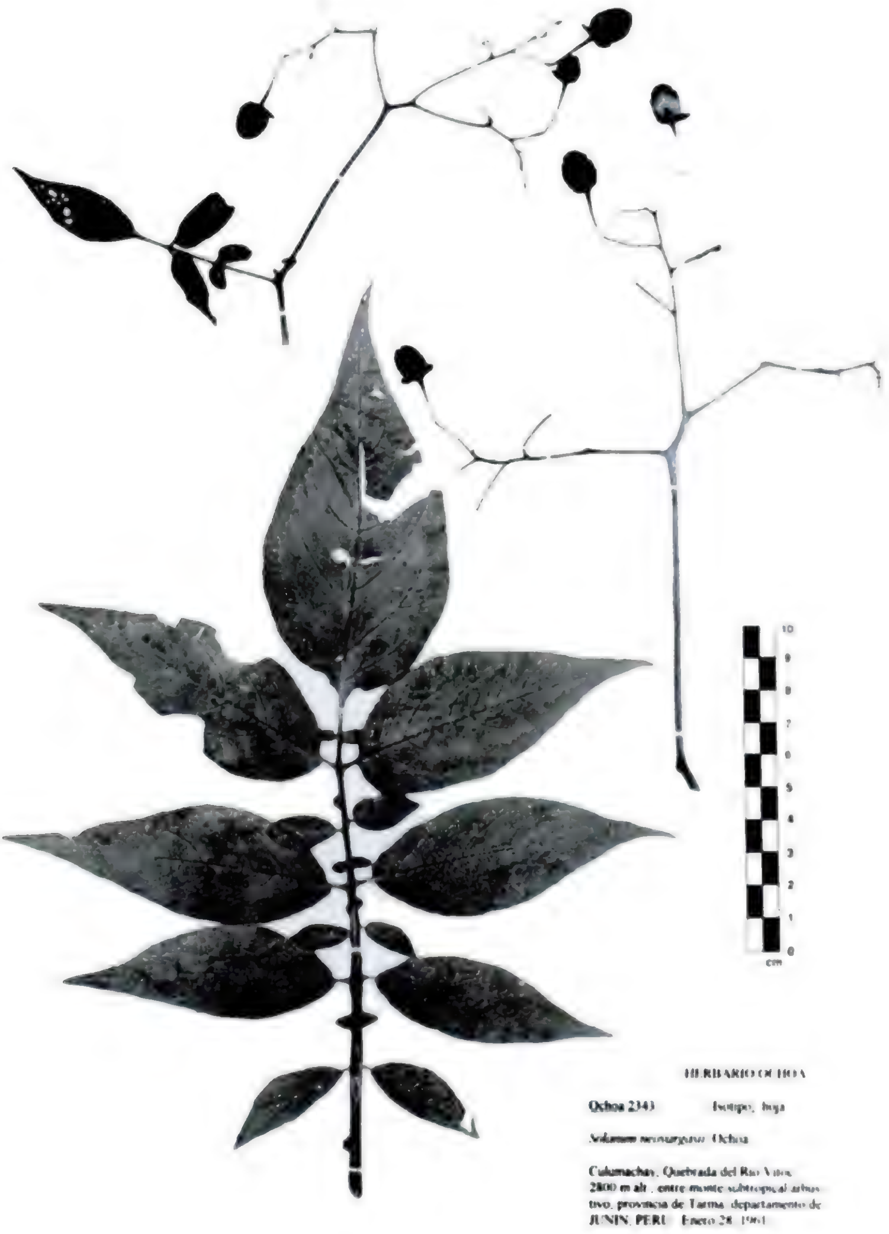
Type: PERU. Department Junín, Province Tarma [today Province Chanchamayo], Culumachay, 2800 m alt., in the quebrada of the Vitoc River, among subtropical mountain shrubs, 28 January 1961, C. *Ochoa 2343* (holotype OCH, isotypes MOL, USM).

Affinities

Although *S. neovargasii* is very closely related to *S. laxissimum*, it differs from that species by such important characteristics as the nature of its pubescence, plant habit (including its lesser vigor), sparsely pilose leaves with a greater number of interjected leaflets, calyces that are characteristically symmetrical, rotate corolla with short lobes and short, broadly-triangular acumens, and long and essentially ovoid fruits and very small tubers.

Habitat and Distribution

An inhabitant of the *Ceja de Montaña*, *S. neovargasii* grows among the trees and shrubs of this very moist, eastern slope region at Marainioc and Vitoc in the Province of Chanchamayo, Department of Junín (Map 5).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HERBARIO OCHOA
Ochoa 2343
Isotipo, hoja
Solanum neovargasii Ochoa
Culumachay, Quebrada del Rio Vitoc
2800 m alt., entre monte subtropical arbus-
tivo, provincia de Tarma, departamento de
JUNIN, PERU Enero 28

Figure 62. *Solanum neovargasii* (*Ochoa 2343*, isotype).

Specimen Examined

Department Junín

Province Tarma: Quebrada of the Vitoc River, 2800 m alt., among mountain shrubs, corolla rotate, purple, berries ovoid, 28 January 1961, *C. Ochoa 2343* (MOL, OCH, USM, type collection of *S. neovargasii*).

14. *Solanum nubicola* Ochoa, An. Cien., Universidad Nac. Agr., Lima 8 (3-4):143-146, illustr., 1970. Figs. 63-67; Map 9.

Plant erect-ascending 50-70 cm tall, subglabrous or very sparsely pilose; stem generally simple or little branched, straight or slightly flexed, 6-8 mm in dia. at base, cylindrical, wingless or very narrowly winged, sparsely pilose, covered with tetralobular glandular hairs in the leaf axils, light green or slightly pigmented in the basal one-third of its length; internodes (1.5-)2.5-6.0(-8.0) cm long. Stolons 50-80 cm long, white, thick and fleshy; tubers ovoid to elongate fusiform or long subcylindrical, white, long, 4-8 cm in length (Fig. 66). Leaves (11.5-)14.0-24.5(-29.0) cm long by (7.0-)9.0-15.0(-19.5) cm broad, imparipinnate with (2-)3-4 pairs of leaflets and (0-)1-3 pairs of interjected leaflets, more or less sparsely pubescent; leaflets elliptic-lanceolate or narrowly elliptic-lanceolate, the apex pointed or subpointed to subobtuse; terminal leaflet slightly larger than the laterals, (5.0-)7.5-10.0(-12.0) cm long by (2.0-)3.5-4.0(-6.0) cm broad, the base cuneate or subcuneate; first pair of lateral leaflets (3.3-)4.5-7.5(-11.5) cm long by (1.2-)1.5-2.5(-5.0) cm broad, the base obliquely rounded, sessile or subsessile and basiscopically very narrowly decurrent about the rachis; the remaining pairs of leaflets diminishing gradually in size toward the base, shortly petiolulate; petiolules 1.5-2.5 mm long, the last pair sessile and considerably smaller than the others; interjected leaflets, when present, very small, 1.5-8.0 mm long, elliptic to orbicular, sessile. Pseudostipular leaves narrowly obliquely elliptic, very small or inconspicuous, 3-5 mm long. Inflorescence cymose to cymose-paniculate, 5-12-flowered; peduncle bracted, short, (2-)5-7 cm long by 1.5-2.0 mm in dia., light green or slightly pigmented, as in the case of the pedicels, covered with very short simple hairs and very small tetralobular glandular hairs; pedicels 15-20(-25) mm long, pigmented like the calyx; articulated slightly above center, or about 8-10 mm below base of calyx. Calyx small, 5-6 mm long, sparsely pubescent; lobes ovate-lanceolate to elliptic-lanceolate, the apex pointed or subapiculate. Corolla rotate, very small, 2.5-3.0 cm in dia. (Fig. 64), light purple with whitish acumens and a light gray internal star. Anthers very narrowly lanceolate, 5.5-6.0 mm long, pale yellow or lemon yellow, without a definite dorsal suture; filaments short, 1 mm long, pigmented lilac or purple, densely pubescent

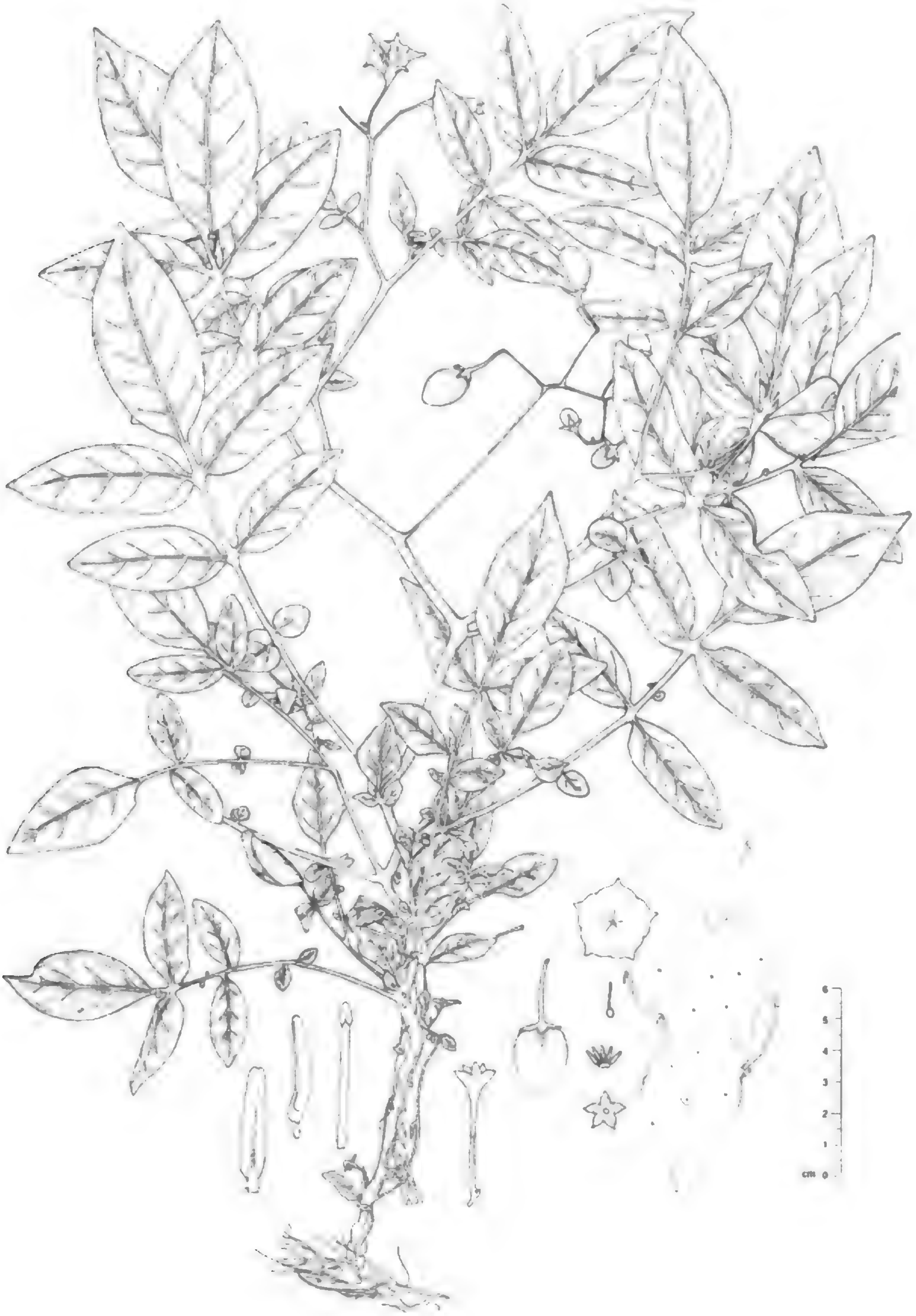


Figure 63. *Solanum nubicola* (*Ochoa 2648*, holotype).

externally. Style 8.5-9.0 mm long, very slender or filiform, papillose below the midpoint; stigma capitate, small, slightly enlarged toward the apex of the style. Fruit long-conical to ovate-conical, light green, 15-20 mm long (Fig. 65). Chromosome Number: 2n=48.

Local Name: *Papa de Zorro.*

Type: PERU. Department Huánuco, Province Huamalíes, foothills of Cerro Jaroggocha, 3600 m alt., Pacsapampa, between Jircán and Tantamayo, April 28, 1967, C. *Ochoa 2648* (holotype OCH, isotype US).

According to local sources, this wild potato is resistant to attacks of the late blight fungus, *Phytophthora infestans*. The farmers consume its tubers in years of scarcity, or bad harvests.

Affinities

Solanum nubicola is very closely related to *S. chomatophilum*, the latter species a near ancestor and one from which it has been apparently derived. However, the two differ substantially in certain of their characteristics. Thus, *S. nubicola* is self-compatible and tetraploid. Moreover, this species is more pubescent than *S. chomatophilum* and produces fairly large tubers. On the hand, *S. chomatophilum* is a self-incompatible diploid, is subglabrous or little pilose, and produces small size tubers only occasionally.

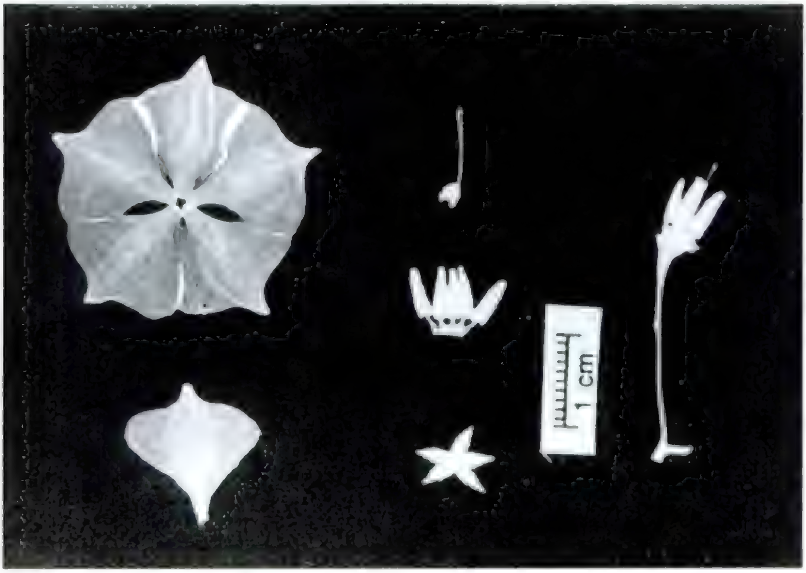


Figure 64. Floral dissection of *Solanum nubicola* (*Ochoa 13335*).

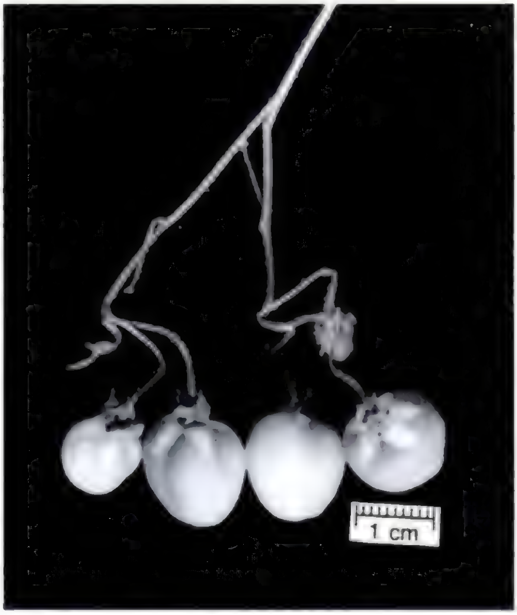


Figure 65. Fruits of *Solanum nubicola* (*Ochoa 13335*).

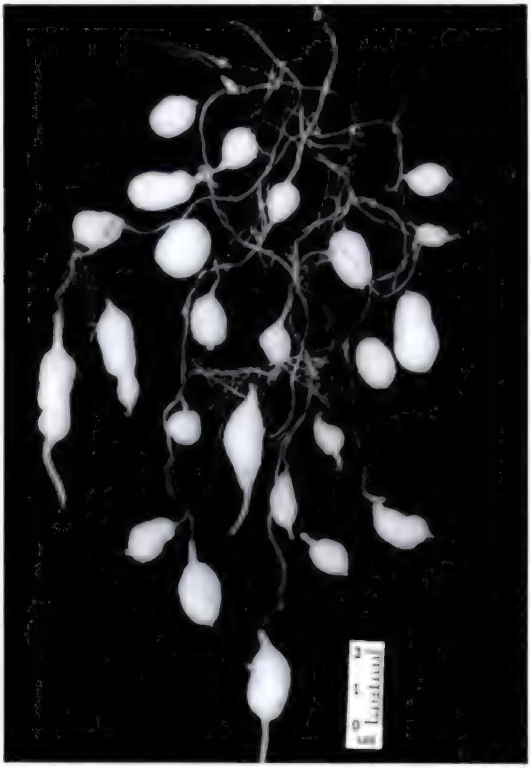


Figure 66. Tuberization of *Solanum nubicola* (*Ochoa 13839*).

Habitat and Distribution

Solanum nubicola is an inhabitant of the *puna* or *jalca*. It prefers the high, cool mountain climates, but in regions marked by *nubosas* (or dense cloud formations) as, for example, persisting for a great part of the rainy season at its type locality. This species grows on steep slopes, under the protection of woody thickets comprised of plants bearing drip-tips, these represented principally by such relic genera as *Barnadesia*, *Buddleja* and *Polylepis*, and various grasses. More rarely is this species found in open fields or on gentle slopes in soils rich in humus and spread with a mantle of *Hypericum laricifolium*. In these areas it may also be associated with *Poa*, *Stipa*, *Gentiana* and *Lobelia*.

This species occurs principally in the Province of Huamalíes, Department of Huánuco, but a peripheral extension of its range is found in the Province of Pataz in the Department of La Libertad in northern Peru. It's altitudinal limits are between 3300 and 3600 m (Map 9).

Specimens Examined

Department Huánuco

Province Huamalíes: Lower slopes of Cerro Huiro Huiro, 3460 m alt., facing the Carpa lagoon, Distr. Tantamayo, in *jalca*, among tufts of *Stipa ichu,* in moist black soils, 26 April 1961, *C. Ochoa 2360* (OCH). In a cold and narrow quebrada (*puna*), 3260 m alt., near the right bank of the Carpa River, along the bridle trail from Tantamayo to Urpish, plants robust to 1 m tall, past flowering, 27 April 1961, *C. Ochoa 2363* (OCH). Near Sausián, 3300 m alt., about 25 m from the left bank of the Sausián River, among *aliso* trees (= *Alnus* sp.), along the bridle trail from Tantamayo to Urpish, 27 April 1961, *C. Ochoa 2364* (OCH). *Jalcas* of Condorchaca, near Sausián, 3600 m alt., between Tantamayo and Jircán, 26 April 1967, *C. Ochoa 2646A* (OCH). Foothills of Cerro Jaroggocha, 3610 m alt., Pacsapampa, between Jircán and Tantamayo, along the bridle trail via Huaguín, among relic stands of shrubs and grasses, 28 April 1967, *C. Ochoa 2648* (OCH, US, type collection of *S. nubicola*). Facing the Carpa lagoon, between Tantamayo and Arancay, 3600 m alt., from the originally collected seed, April 1967, *Och S-69*, 2n=48 (OCH, from plants grown at Sturgeon Bay, Wis., USA, in 1969). *Jalcas* or *punas* along the eastern side of Carpa lagoon, 3500 m alt., in a small relic forest stand comprised of trees *Buddleja* and *Polylepis,* associated with small shrubs of *Hypericum laricifolium*, some herbaceous ferns and tufts of *Stipa ichu,* on very moist black soil, tubers large, long flattened, white, 5-6 cm long, 15 April 1980, *C. Ochoa 13839*, 2n=48 (CIP, GH, OCH, US). *Punas* of Quishuarpata, 3600 m alt., along the bridle trail from Tantamayo

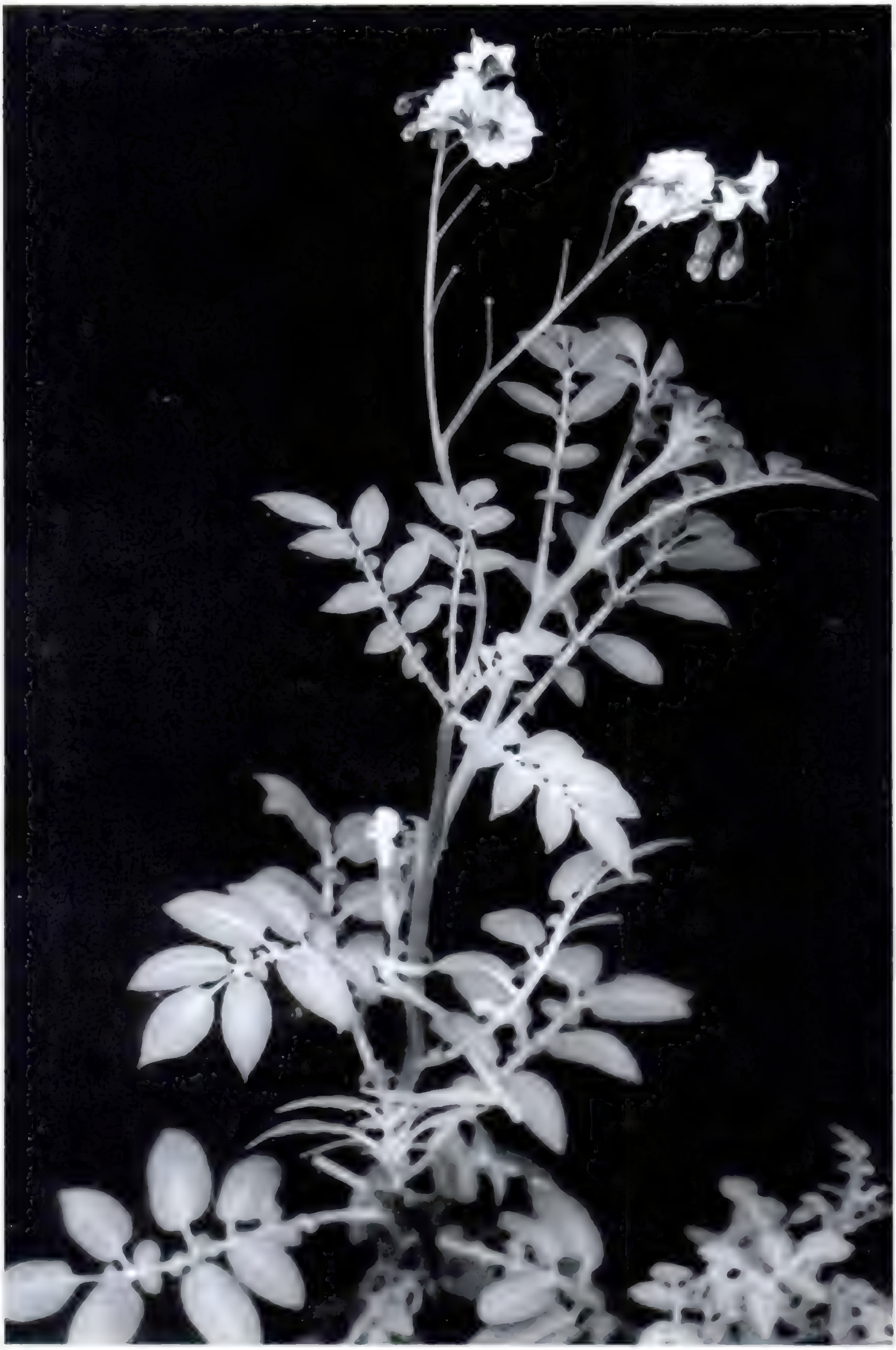


Figure 67. Living plant of *Solanum nubicola* (*Ochoa 13335*).

to the Carpa lagoon, in a small quebrada forest comprised of trees of *Mancaquirpa* (= *Polylepis* sp.), berries long and conical, tubers abundant, slender, ovoid and elongated or long flattened to subcylindrical, to 8 cm long, 15 April 1980, C. *Ochoa 13841*, 2n=48 (CIP, GH, OCH, US), *13842*, 2n=48 (CIP, OCH, US, from plants grown in the greenhouse at Huancayo), and *13843* (from floral dissection only).

Department La Libertad

Province Pataz: Palo Seco, 3650 m alt., about 3 hours by horse traveling below the *jalcas* of Tauli toward Huarimarca, in extensive grassland, sterile, past flowering, berries abundant, few tubers, very rare, 7 May 1979, C. *Ochoa 13335*, 2n=48 (CIP, OCH, US), and *13335-A* (CIP, GH, OCH, US, from plants grown in the field at Huancayo).

15. *Solanum pillahuatense* Vargas, *Las Papas Sudperuanas*, Publ. Univ. Nac. Cusco, Part. I:90-91, Fig. 35, 1949, *nom. nud.*, Part II:53-54, 1956.

Figs. 68-71; Map 6.

Plant lax-ascending, (25-)35-45(-60) cm tall, more or less pilose. Stem slender 2-4 mm in dia. at base, simple or branched, sparsely pilose, light green, pigmented or flecked with dark purple along the lower two-thirds of its length, internodes (2-)3-5(-10) cm long; stolons 50 cm long; tubers white, round to ovoid, 2-3 cm long. Leaves short and broad (11.0-)12.5-16.5(-18.5) cm long, including the petiole, by (4.5-)9.0-10.0(-13.0) cm broad, densely pilose on both sides, hairs short, white and adpressed; petioles 3.5-5.0(-7.0) cm long, rachis and petioles pilose, very narrowly winged. Leaves imparipinnate with (1-)2-3 pairs of lateral leaflets, usually without interjected leaflets; leaflets ovate or broadly elliptic to elliptic-lanceolate; the terminal leaflet slightly larger than the laterals, (3-)4-6(-7) cm long by (1.6-)2.4-3.0(-4.0) cm broad, the apex shortly acuminate and the base broadly rounded or somewhat cuneate; apex of the lateral leaflets obtuse or slightly acuminate and the base symmetrical or asymmetrically rounded, subsessile or shortly petiolulate, on petiolules 1.5-2.5 mm long; the first pair of leaflets 3-6 cm long by 1.6-2.5 cm broad. Pseudostipular leaves falcate or broadly lunate, 5-10 mm long. Inflorescence subterminal or lateral, cymose-paniculate, 10-15 (-18)-flowered. Peduncle 3-6 cm long by 1.5-2.0 mm in dia., forked, densely and coarsely pilose and somewhat glandular like the pedicels and calyx; pedicels 15-20 mm long; articulated near center or slightly below center, usually 7-9 mm below the base of the calyx. Calyx 6-7 mm long with membranous, narrowly ovate-subquadrangular lobes and shortly acuminate apex. Corolla rotate to rotate-pentagonal, small, 2.0-2.5 cm in dia. (Fig. 69), blue-lilac with a whitish-gray

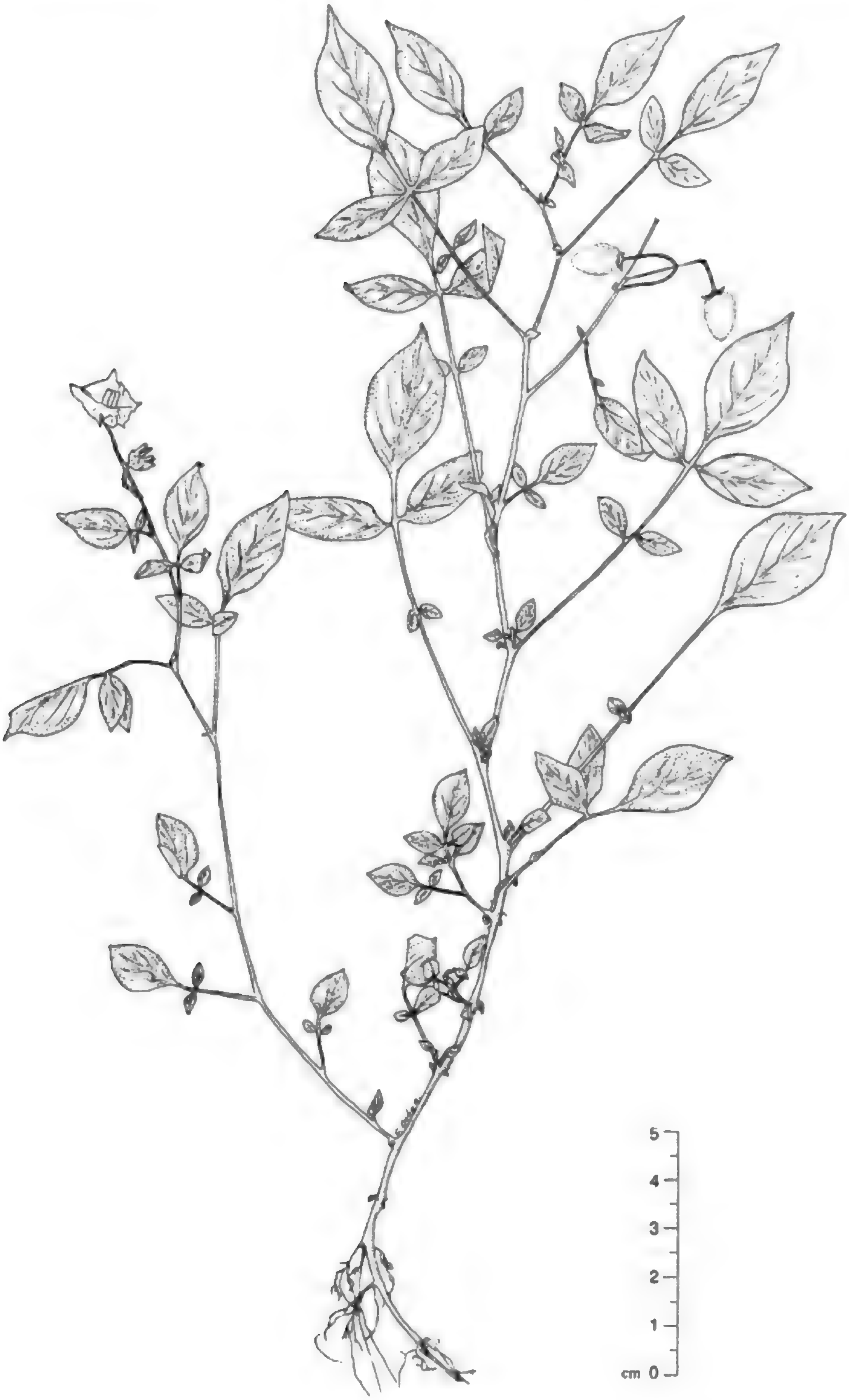


Figure 68. *Solanum pillahuatense* (*Ochoa 13651*, topotype).

internal star. Anthers 6-7 mm long, narrowly oblong-lanceolate, base cordate; filaments 1 mm long, glabrous. Style 9-10 mm long, densely papillose along the lower two-thirds of its length; stigma capitate, small. Fruit ovate-conical, 1.2-1.5 cm long, green with some vertical pale-violet streaks. Chromosome Number: 2n=24. EBN=2.

Type: PERU. Department Cusco, Province Paucartambo, *Ceja de Montaña* of Pillahuata, 2800 m alt., between Pillahuata and the Aguila Pass, 25 January 1945, *C. Vargas C. 4924* (syntypes CUZ, LL, OCH, lectotype here designated CUZ).

Affinities

Solanum pillahuatense is closely related to *S. urubambae*. Both are alike in being pubescent over the entire plant and in having a cylindrical stem, as well as similarly formed corollas, pedicels, leaves and leaflets.

Habitat and Distribution

This species grows among thickets and shrub forests and along the margins of tree forests at elevations between 2800 and 3650 m in the *Ceja de Montaña*, a

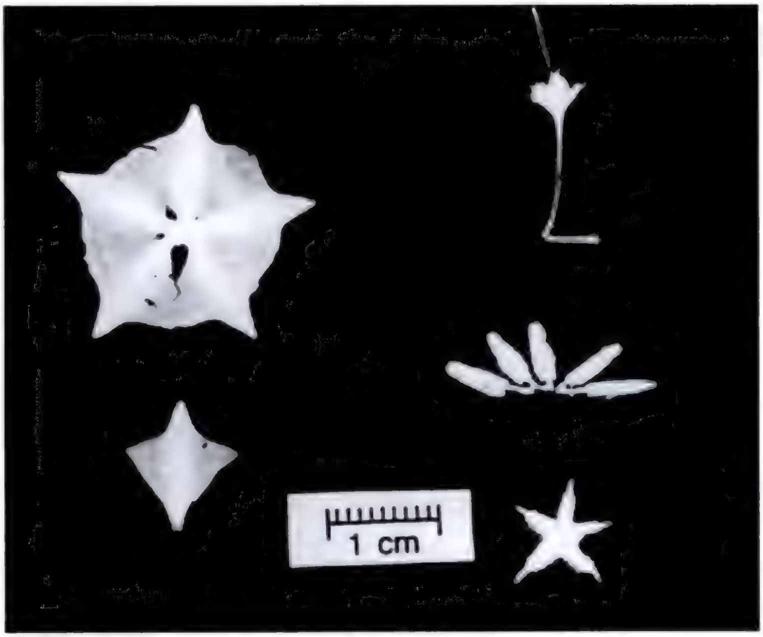


Figure 69. Floral dissection of *Solanum pillahuatense* (*Ochoa 13651*).

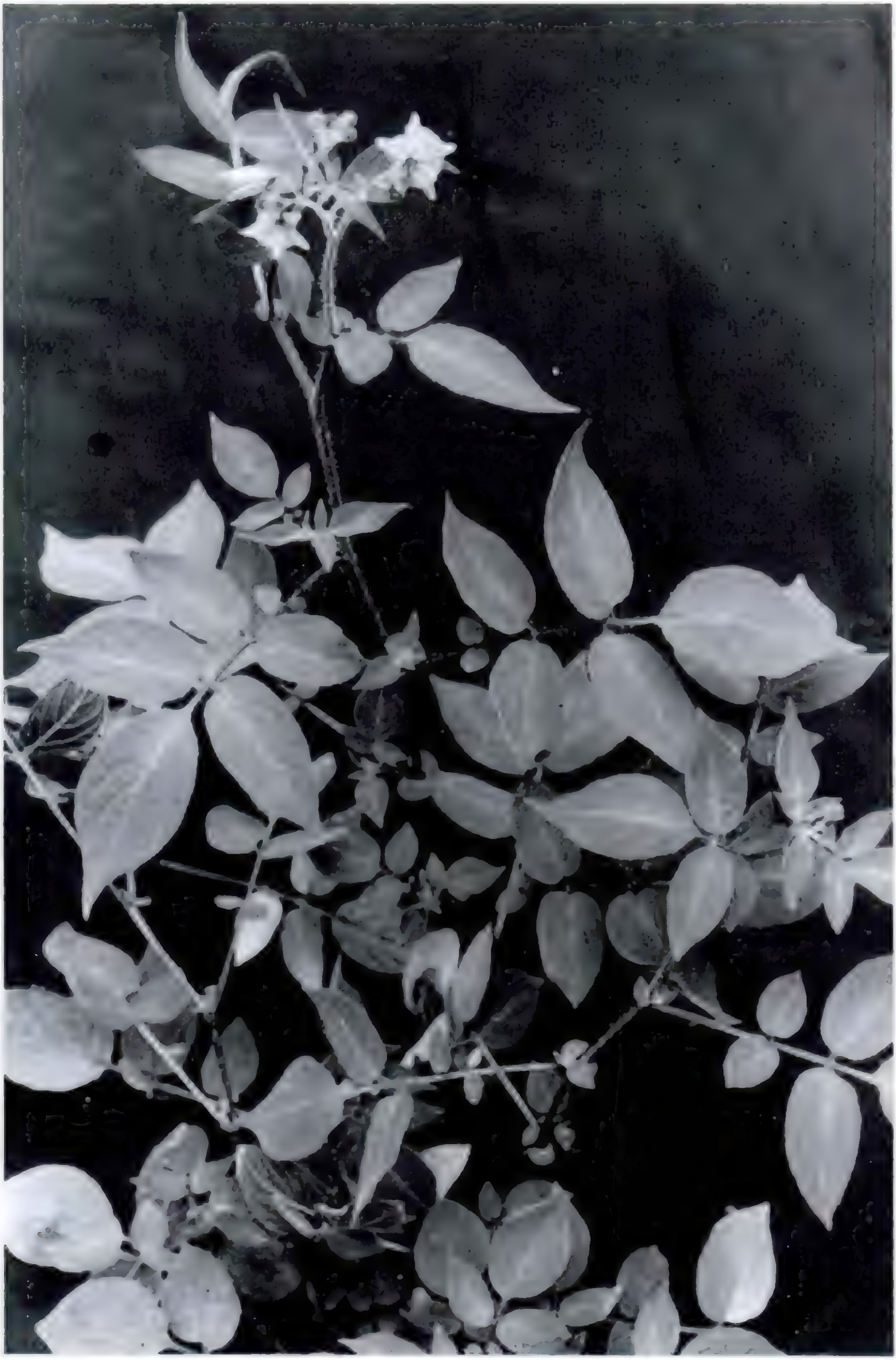


Figure 70. Living plant of *Solanum pillahuatense* (*Ochoa 13651*).

very humid and rainy region that spreads between Pillahuata and the Aguila Pass in the Province of Paucartambo, Department of Cusco, in southern Peru.

Specimens Examined

Department Cusco

Province Paucartambo: *Ceja de Montaña* at Pillahuata, between Aguila Pass and Pillahuata, 2800 m alt., along the edges of mountain shrubs in soil [moist], stony, 25 January 1945, *C. Vargas C. 4924* (CUZ, LL, OCH, type collection of *S. pillahuatense*). Puyupata, 3400 m alt., flowers purple, on low mountain, 10 February 1953, *F. Woytkowski 440 p.p.* (MOL). Llutuyocc, 3300 m alt., flowers purple, under forest trees, 15 March 1953, *F. Woytkowski 608* (MOL). Pillahuata, 25 January 1967, *C. Vargas C. 18847* (OCH, from a plant grown in the garden of C. Vargas C. in Urubamba, Cusco, from seed originally collected in Pillahuata). Pillahuata, 2750 m alt., between Paso del Aguila and Pillahuata, before Santa Isabel between shrub forests or along the edges of forests of short trees, 25 February 1980, *C. Ochoa 13651*, 2n=24 (topotypes of *S. pillahuatense* CIP, F, GH, MOL, OCH, US). Note: C. Vargas indicated (in his *Las Papas Sudperuanas*,

Figure 71. Pillahuata (2750-4000 m alt.), Province of Paucartambo, Cusco, habitat of *Solanum pillahuatense*.

Univ. Nac. Cusco, I, 91, 1949) that he had collected S. *pillahuatense* (under field No. *2247)* in the highlands of Pillahuata up to 3650 m (CUZ). However, I have not seen his specimen.

16. *Solanum rhombilanceolatum* Ochoa, Rev. Argentina Agron. 19:234-237, Figs. 3-4, 1952. Figs. 72-74; Map 5; Plate. VI.

Plants delicate, little vigorous, 30-40(-50) cm tall, erect, branched-ascendent to slightly decumbent, sparsely pubescent. Stem simple or branched in the basal one-third of its length, erect or slightly sinuous, slender, 2-5 mm in diameter at base, pigmented dark purple, with broad, straight, light green wings, more or less densely pilose, the hairs of unequal size, 2-3 mm long, white, translucent; internodes short, 0.6-1.5 (-3.0) cm long. Stolons 30-70 cm long, very slender, 1.5 mm in diameter; tubers small, 1.0-1.5 cm long, round to ovoid, white-skinned. Leaves imparipinnate, poorly dissected, with 2-3(-4) pairs of leaflets and 0-2(-3) pairs of interjected leaflets, (5.0-)8.0-13.0(-14.5) cm long by (3.5-)4.0-7.5(-9.0) cm broad, including the rachis and petiole, pilose above or sparsely so with white adpressed hairs, these of somewhat greater length on the veins but shorter on the veinlets and epidermal surfaces, and with some short glandular hairs intermixed below. Leaflets rhombic-lanceolate to elliptic or narrowly elliptic-lanceolate, the apex subobtuse or pointed to shortly acuminate and the base cuneate to obliquely rounded, on petiolules 1-2 mm long or subsessile, occasionally narrowly decurrent about the rachis. Terminal leaflet larger than the first pair of laterals, (3.0-)5.0-0.5 cm long by (1.5-)2.0-3.0 cm broad; the first pair of leaflets (2.0-)3.5-5.0 cm long by (1.0-)1.5-2.0 cm broad, the remaining lateral leaflets notably reduced in size. Pseudostipular leaves lunate or narrowly and obliquely elliptical, 0.5-1.0 cm long. Inflorescence cymose-paniculate and terminal or lateral, 4-12-flowered. Peduncle very large, up to 12 cm long and 2.0-2.5 mm in dia. at base, densely pubescent like the pedicels and calyx; pedicels slightly pigmented, 15-20(-25) mm long; articulated in the upper one-third of their length or much above the midpoint, about 5.5-6.5 mm below the base of the calyx. Calyx symmetrical or asymmetrical, 7-9 mm long, pubescent, the lobes ovate-lanceolate with scarious margins, abruptly narrowed to the acumens, 2.0-2.5 mm long. Corolla rotate, purple-violet, showy, large, to 4.5 cm in dia., with a greenish-white internal star (Fig. 73). Staminal column cylindrical-conical, anthers narrowly lanceolate, 6.7-7.0 mm long; filaments 1.5-2.0 mm long, slender, glabrous. Style 10.5-11.5 mm long, very slender or filiform, exerted 3 mm,

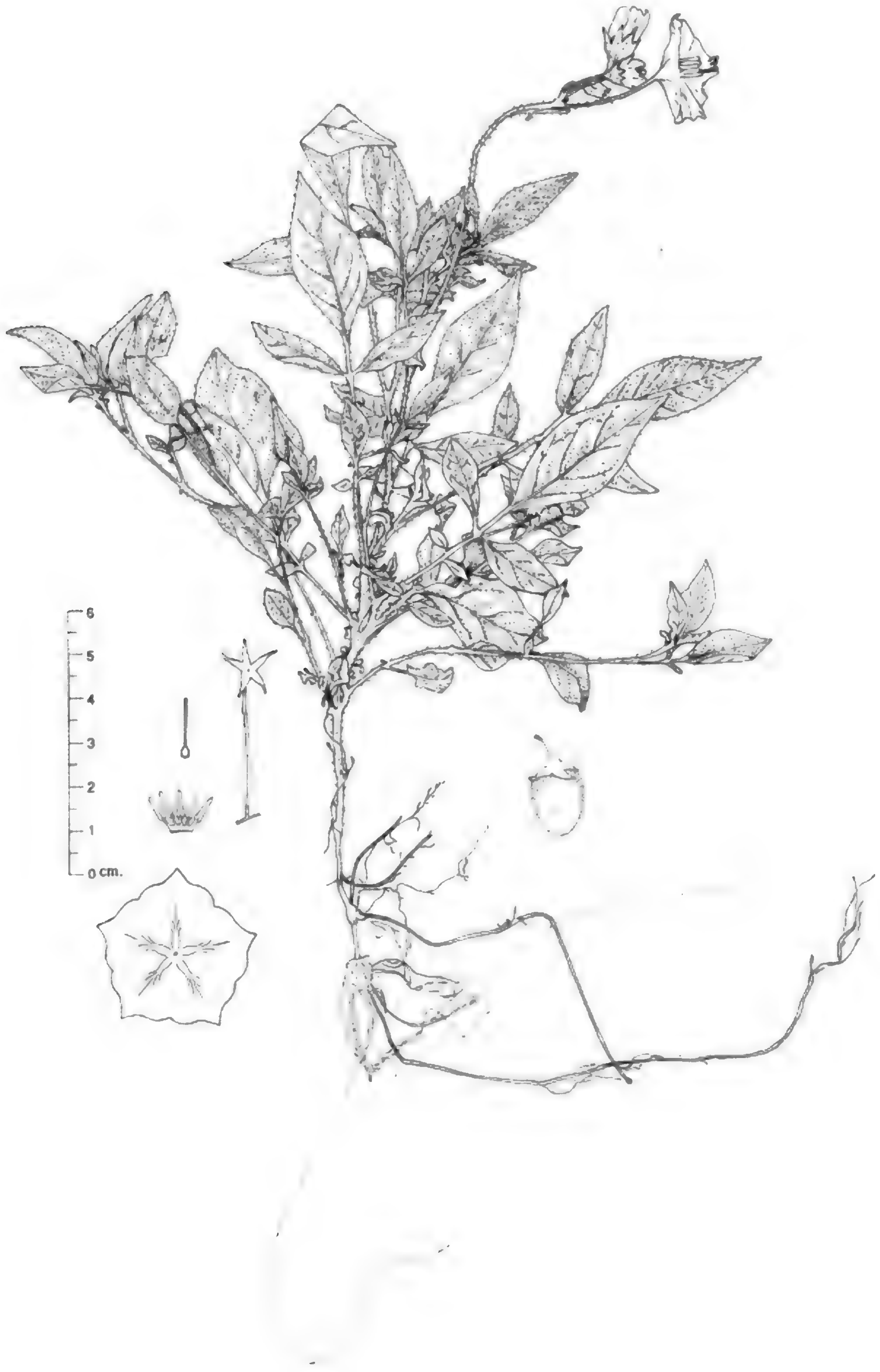


Figure 72. *Solanum rhombilanceolatum* (*Ochoa 1394*, holotype).

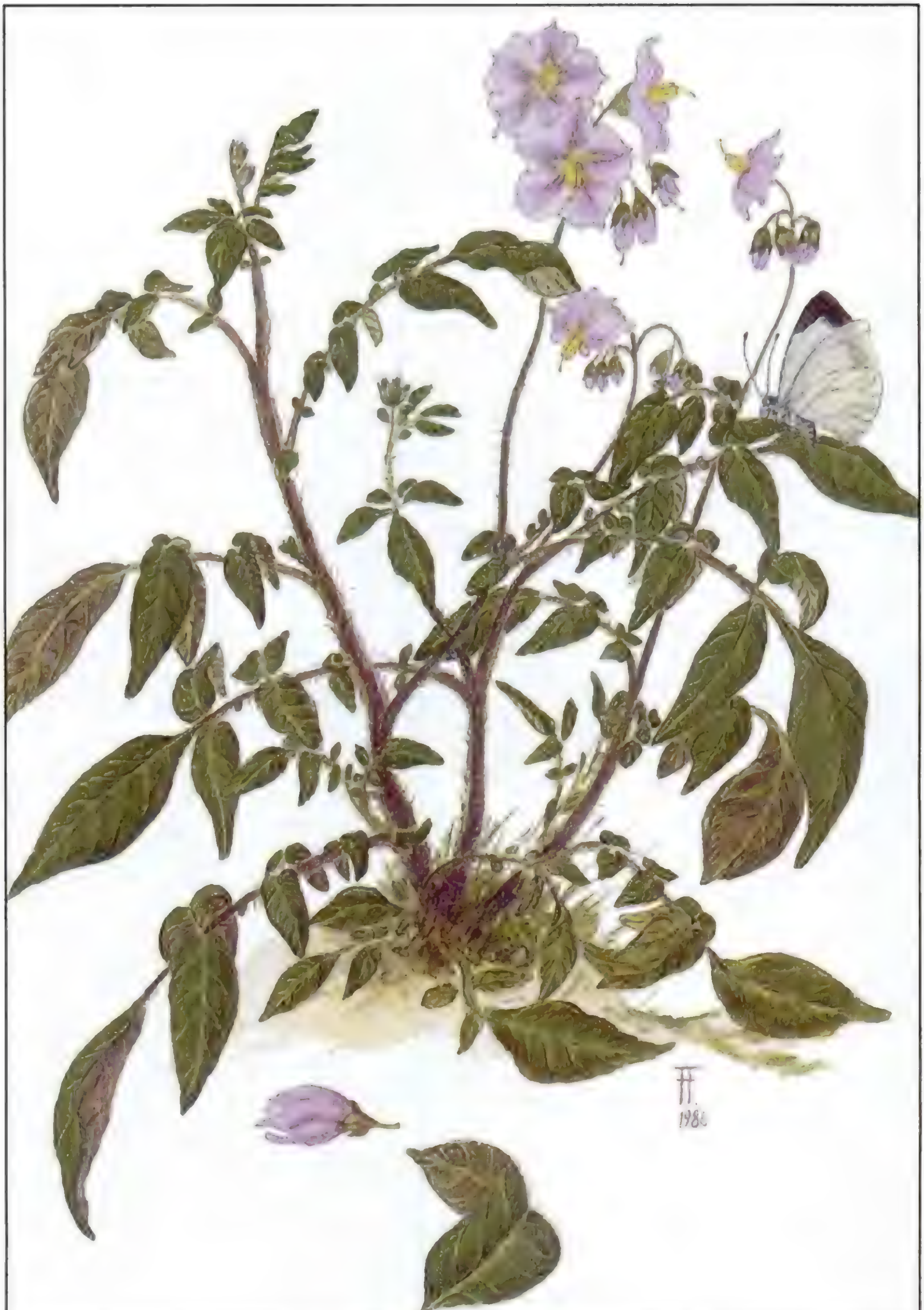


Plate VI. *Solanum rhombilanceolatum* Ochoa.

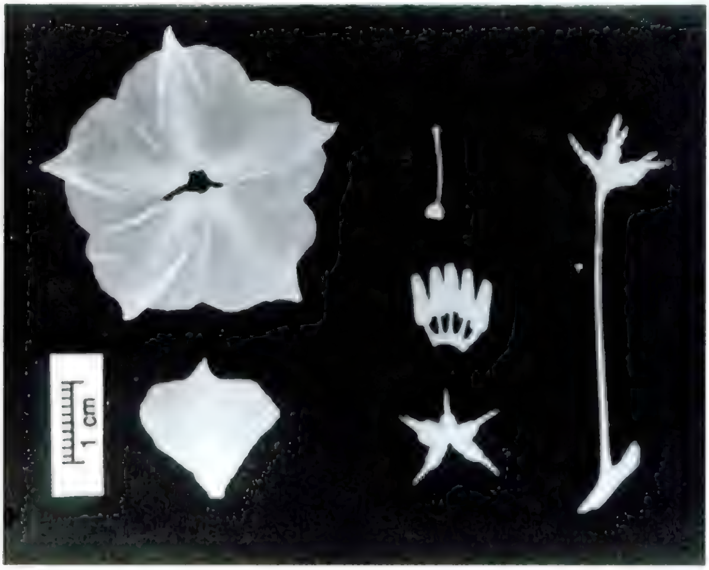


Figure 73. Floral dissection of *Solanum rhombilanceolatum* (*Ochoa 13112*).

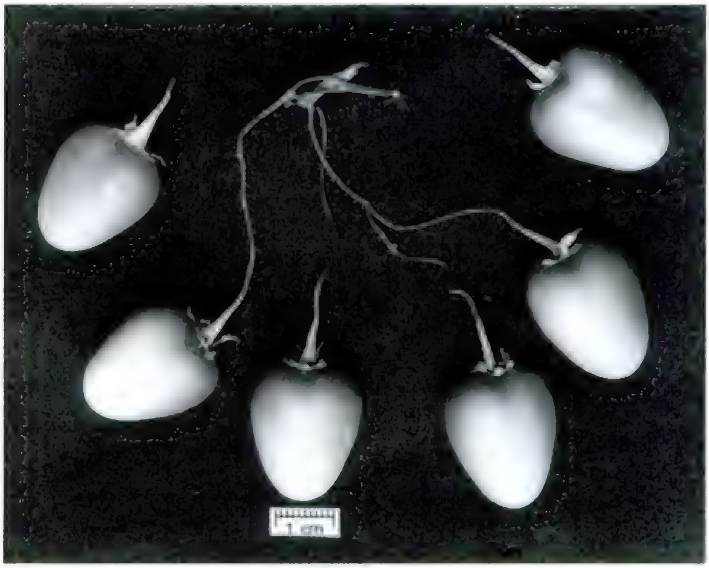


Figure 74. Berries of *Solanum rhombilanceolatum* (*Ochoa 11869*).

densely papillose along the basal one-third of its length; stigma capitate, cleft. Fruit ovoid or elongated conical, dark green, blushed with violet at base, to 3 cm long by 1.8 cm in dia. at base (Fig. 74). Chromosome Number: 2n=24. EBN=2.

Type: PERU. Department Junín, Province Huancayo, vicinity of Pahual, 2900 m alt., near Chirifruta, along the railroad to Pariahuanca, 20 January 1952, C. *Ochoa 1394* (as *S. rhombilanceolatum*; holotype OCH, designated here; isotypes K, US) and C. *Ochoa 1395* (paratypes OCH, GH).

Affinities

Although *S. rhombilanceolatum* shows a certain amount of affinity to *S. ancophilum*, this as suggested by their rather similar leaves and the shape and pilosity of their leaflets, the two species are really very different from one another with respect to their berries and flowers. They grow, moreover, in very different habitats.

Habitat and Distribution

Although this species appears to grow preferentially in the *Ceja de Montaña* along the eastern side of the Province of Huancayo, it is also found in the mountains of Pariahuanca and below Mantaro in the Department of Junín. And it is found in the milder and drier climates of the interandean valleys, as in the case of the foothills of Razuwillca, heading down toward Huanta Valley in the Department of Ayacucho. Its altitudinal limits vary between 2100 and 3200 m (see Map 5).

Specimens Examined

Department Ayacucho

Province Huanta: Mio, 2900-3000 m alt., between Huanta and Culluchaca, scarce, flowers violet, 13 March 1967, C. *Ochoa 2615* (OCH).

Department Junín

Province Huancayo: Yacutianan, 2200 m alt., heading down toward Pariahuanca, in dense shrub forests and along the margins of tree forests, scarce, 20 January 1952, C. *Ochoa 1390* (OCH). Vicinity of Chirifruta, 2100 m alt., in shrub borders along the railway to Pariahuanca, 20 January 1952, C. *Ochoa 1391* (OCH). Pahual, 2900 m alt., near Chirifruta, along the road to Pariahuanca, in *ceja de montaña* and in moist soils, 18 January 1952, C. *Ochoa 1394*, 2n=24 (type collection of *S. rhombilanceolatum* K, OCH, US), and *C. Ochoa 1395* (paratypes GH, OCH). Near Eluyo, 3200 m alt., heading down the quebrada of Pumacancha toward Pahual, on the road to Chirifruta, among large stones in shrubland and along the margins of forests, 1 February *1978, C. Ochoa and A. Salas 11869*, 2n=24 (CIP, OCH, plants propagated at Huancayo from original cuttings). Pahual, 2900 m alt., heading down to Chirifruta, plants small, 20 cm tall, flowers purple, 22 January 1979, *C. Ochoa and A. Salas 13111* (CIP, F, OCH) and *13112*, 2n=24 (topotypes CIP, F, MOL, OCH, US, USM). Between Eluyo and Pahual, 3100 m alt., heading down to Chirifruta, on the road to Pariahuanca, along forest margins, 6 April 1981, *C. Ochoa and A. Salas 14406*, 2n=24 (CIP, MOL, OCH, US, USM).

Table 15. Fertility of *Solanum rhombilanceolatum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	LIGNICAULIA	× *S. lignicaule*	6	6	0
		PIURANA	× *S. humectophilum*	5(3)	5(2)	0(0)
24	2	CONICIBACCATA	× *S. chomatophilum*	53(17)	45(7)	43(16)
			× *S. chomatophilum* f. *sausianense*	8	4	8
			× *S. laxissimum*	56(24)	26(19)	52(2)
			× *S. limbaniense*	10(14)	10(14)	290(112)
			× *S. urubambae*	9	6	235
24	2	MEGISTACROLOBA	× *S. raphanifolium*	8	5	100
24	2	TUBEROSA	× *S. bukasovii*	48(78)	39(48)	138(130)
			× *S. goniocalyx*	31	21	54
			× *S. marinasense*	10(3)	9(1)	9(13)
			× *S. orophilum*	2(15)	1(1)	5(31)
			× *S. phureja*	34(1)	30(1)	81(10)
48	4	TUBEROSA	× *S. tuberosum* subsp. *andigena*	3	2	40

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

The results of crosses made with *S. rhombilanceolatum* are given in Table 15; whereas the materials used in these experiments are shown in Table 16. Complete compatibility was observed in crosses involving *S. rhombilanceolatum*, *S. chomatophilum* and *S. limbaniense* (all of series Conicibaccata and all having 2n=24 and EBN=2). Results indicating partial compatibility of the species were obtained in crosses of *S. rhombilanceolatum* with *S. laxissimum* (2n=24 and EBN=2), but only when *S. rhombilanceolatum* was used as the male parent. Similarly, compatibility was found in reciprocal crosses involving *S. bukasovii*, *S. marinasense*, *S. orophilum* and *S. phureja* (all of series Tuberosa with 2n=24 and EBN=2). Success was also obtained in unilateral crosses with *S. urubambae* (2n=24 and EBN=2) of the series Concibaccata, which yielded the highest average numbers of seeds per berry (more than 200). It is also interesting to note the ease by which unilateral crosses of *S. rhombilanceolatum* could be made with species of series Megistacroloba and Tuberosa, such as *S. raphanifolium*, *S. goniocalyx* (2n=24 and EBN=2) and *S. tuberosum* subsp. *andigena* (2n=48 and EBN=4). Finally, incompatibility was observed in species crosses involving *S. rhombilanceolatum* and *S. humectophilum* of series Piurana and *S. lignicaule* of series Lignicaulia, both 2n=24 and EBN=1.

Table 16. Collections (OCH) used in *Solanum rhombilanceolatum* fertility studies.

CONICIBACCATA
S. chomatophilum 11281, 13199, 13201, 13203, 13844, 14786
S. chomatophilum f. *sausianense* 13840
S. laxissimum 11855,13188, 13189
S. limbaniense 14291, 14405
S. rhombilanceolatum 11869, 13111, 13112, 14406
S. urubambae 13778, 13781

LIGNICAULIA
S. lignicaule 11617, 14416

MEGISTACROLOBA
S. raphanifolium 14298, 14318

PIURANA
S. humectophilum 13247

TUBEROSA
S. bukasovii 8693, 11337, 13128, 13582, 13714, 13730, 14332, 14333, 14372, 14381, 14382, 14383, 14399, 14407, 15115
S. goniocalyx 00001, 3496
S. marinasense 13749, 13809
S. orophilum 12079
S. phureja 5109, 13896, 13898, 13910, 15071
S. tuberosum subsp. *andigena* 13890.

17. *Solanum salasianum* Ochoa, Am. Potato J. 66(4):235-238, illustr., 1989.
Figs. 75-76; Map 9.

Plants robust, erect to erect-ascending, 50-60(-100) cm or more tall, puberulent to velutinous. Stem generally simple, straight or slightly flexed, cylindrical, very short and sparsely pilose, more densely pilose in the terminal one-third of its length, wingless, light green or slightly pigmented in the leaf axils; internodes (2.5-)4.0-6.0 cm long. Stolons white, 1.5 m or more long and 2-3 mm in dia.; tubers round to ovoid, small, 2-3 cm long, white. Leaves imparipinnate, (8.0-) 15.0-22.0(-25.5) cm long, including the petiole, by (7.0-)12.0-15.0(-16.5) cm broad, with 2-3(-4) pairs of leaflets and 2-4(-6) pairs of orbicular to ovate, sessile, and very small interjected leaflets1-4 mm long, petioles 2.0-5.5(-9.0) cm long. Leaflets darker green and more densely pilose above and lighter green and less pilose on the veins and veinlets below, with very pilose margins, hairs very short, silvery-white or straw-colored to almost yellow; the petioles, the rachis and petiolules densely puberulent. Lateral leaflets elliptic-lanceolate, the apex acuminate and the base rounded to obliquely rounded, on petiolules 3-4(-7) mm long. Terminal leaflet somewhat larger and more broadly elliptic-lanceolate than the laterals, (5.0-)6.0-9.5 cm long by (2.0-)3.0-5.5 cm broad, the apex conspicuously acuminate and the base broadly cuneate to subattenuate; the first pair of lateral leaflets (3.5-)5.5-8.0 cm long by (1.5-)2.2-3.5 cm broad; interjected leaflets very small, 1.5-4.0 mm long, orbicular to ovate, sessile. Pseudostipular leaves falcate, the apex obtuse or narrowly obliquely elliptic, 10-15 mm long by 4-7 mm broad. Inflorescence cymose-paniculate, (3-4-)20-flowered; peduncle short and slender, 3-4 cm long and 1.0-1.5 mm in dia., densely puberulent like the pedicels and calyx; pedicels short, 12-15 mm long, articulated below center or very slightly above center. Calyx asymmetrical, rarely symmetrical, small, 5.5 mm long, lobes elliptic-lanceolate or narrowly long triangular-lanceolate, apex apiculate. Corolla rotate 3 cm in dia., pale violet with short acumens and a broad base, internal star pale yellow (Fig. 76). Anthers narrowly lanceolate 6.0-6.5 mm long, pale yellow, base cordate; filaments 1.0-1.5 mm long, glabrous. Style 9-10 mm long, shortly exerted, densely papillose in the basal two-thirds of its length; stigma capitate, cleft, small, slightly enlarged at the apex of the style. Fruit long-conical, light green, 1.5 cm long. Chromosome Number: 2n=24.
Local name: *Jacha Papa*.

Type: PERU. Department Huánuco, Province Pachitea, between Cormilla and Tambo de Vaca, 3000 m alt., March 1973, C. *Ochoa 4629* (holotype OCH). **Paratype:** PERU. Department Huánuco, Province Pachitea, near Tendalpata,

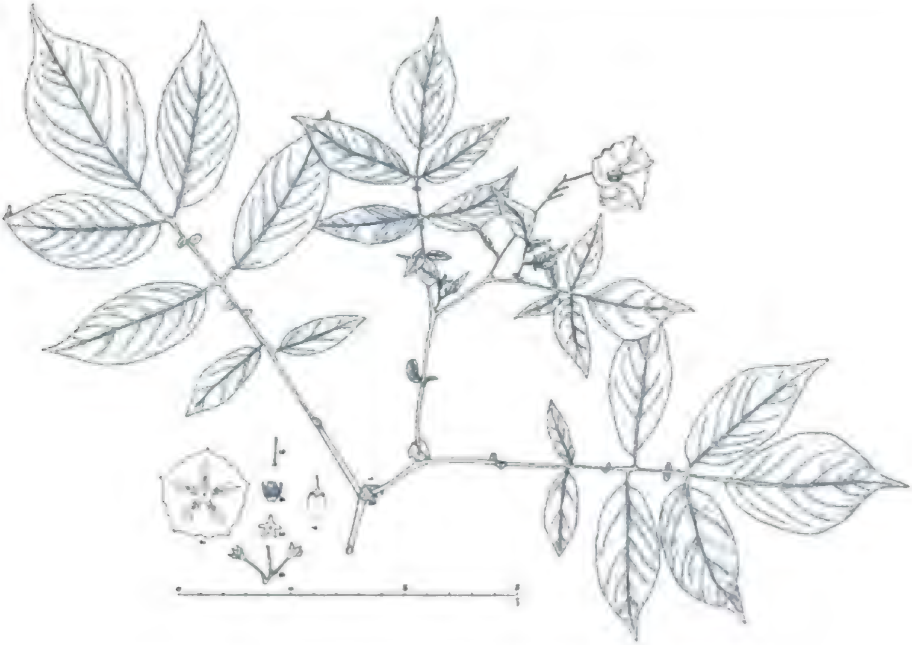


Figure 75. *Solanum salasianum* (*Ochoa 4629*, holotype).

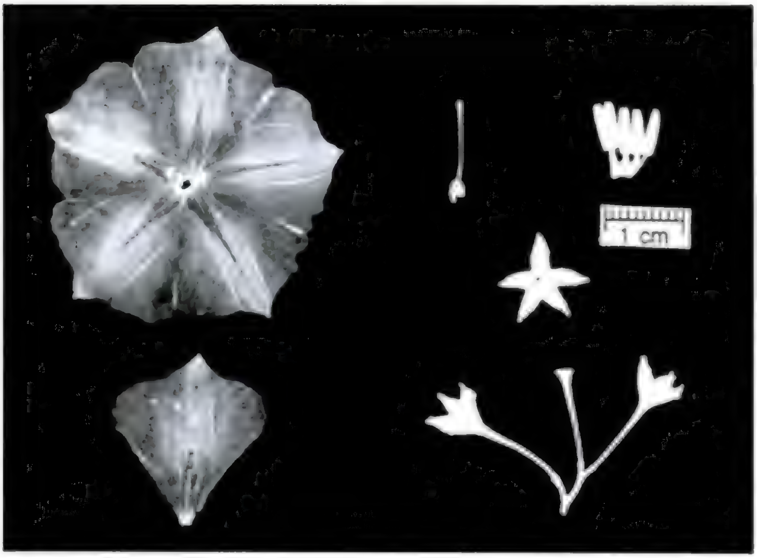


Figure 76. Floral dissection of *Solanum salasianum* (*Ochoa 15750*, paratype).

2800 m alt., between Asia and Monocanca, along the road from Muña to Tambo de Vaca, May 1984, *C. Ochoa and A. Salas 15751* (CIP, OCH).

Affinities

Solanum salasianum is related to *S. urubambae*. The two are similar in having densely pubescent stems and leaves, including the rachis, the peduncle and the pedicels, as well as similarly articulated pedicels. They differ mainly in the shape of the leaves and the form and color of the corolla.

Habitat and Distribution

Solanum salasianum grows in the *Ceja de Montaña*, between 2800-3000 m, in a moist, temperate and cloudy climate. It preferentially grows in soils rich in humus among thicket shrubs or along the margins of forests, where it may be associated with other non-tuberous sp. of *Solanum*, *Calceolaria*, *Chusquea*, *Lupinus*, *Monnina*, *Rubus*, many melastomes, palms, ferns and composites.

Specimens Examined

Department Huánuco

Province Pachitea: Muña trail to Tambo de Vaca, about 8000 feet, mountain, herb, about 3 ft. high, flowers bright lilac, 5-7 June 1923, *J. Francis Macbride 4298* (F). Between Cormilla and Tambo de Vaca, 3000 m alt., along the margins of forests of trees and shrubs, in organically-rich soil, March 1973, *C. Ochoa 4629* (OCH, type collection of *S. salasianum*). Asia, 3000 m alt., between Muña and Tambo de Vaca, along the edges of forests of trees and shrubs and herbaceous thickets, associated with *Chusquea* sp., *Calceolaria,* many ferns, mints and melastomes, plants vigorous from cylindrical stems more than 1 m tall, leaves pubescent, flowers pale violet, May 1984, *C. Ochoa and A. Salas 15750* (MOL, OCH). Near Tendalpata, 2800 m alt., between Asia and Monocanca, on the road from Muña to Tambo de Vaca, along the edges of moist forest, May 1984, *C. Ochoa and A. Salas 15751*, 2n=24 (CIP, OCH). Distr. Chajlla, hamlet of Muña, Toma, 2600 m alt., 2 km west of Asia, among forest trees (*Cecropia* sp., *Weinmania* sp.) and shrubs (melastomes, tree ferns such as *Pteridium* sp., *Chusquea* sp., etc.), herbs (calceolarias) and other non-tuber bearing *Solanums* as the *papancho* or *Solanum nigrum,* n.v. *Jacha Papa*, 25 April 1996, *C. Ochoa and A. Salas 16276* (CIP, MOL, OCH, USM).

18. ***Solanum santolallae*** Vargas, Rev. Argentina Agron. 10(4):397, 1943. *Las Papas Sudperuanas*, Part I, Publ. Univ. Nac. Cusco: 87, Fig. 32, 1949.
Figs. 77-81; Map 10; Plate VII.

S. santolallae var. *acutifolium* Vargas, Rev. Argentina Agron. 10(4):397-398, Fig. 33, 1949. Type: PERU. Department Cusco, Province La Convención, "El Dorado," highlands of Pintobamba, 2900 m alt., 5 August 1943, *C. Vargas 3505* (CUZ).

Plant 60-150 cm tall, ascending to erect-decumbent, essentially glabrous. Stem simple or branched, somewhat sinuous, slender, 5-8 mm in dia. at base, light green in the upper half, pigmented or flecked purple-violet in the basal one-third of its length and in the leaf axils, wings narrow, straight, light green; internodes (2.0-)3.5-6.0(-9.0) cm long. Stolons more than 120 cm long; tubers round to ovoid, slightly compressed, small, 1.5-2.5 cm in dia. (Fig. 80), whitish, slightly diffused with violet, strongly lenticulate, flesh pure white or white with a tint of pigment or streaked violet. Leaves imparipinnate (10-)15-25(-30) cm long by (5-) 11-13(-17) cm broad with (3-)4-5 pairs of leaflets and 0-2(-3) pairs of interjected leaflets, subglabrous or very sparsely pubescent on both sides; slightly brilliant above, frequently pigmented purple-violet below. Leaflets lanceolate to elliptic-lanceolate, narrowly pointed to attenuate-acuminate, the base rounded to obliquely rounded, on petiolules 2-5 mm long. Terminal leaflet slightly larger than the laterals, (4.0-)5.5-8.5(-10.0) cm long by (1.2-)1.5-2.5(-3.5) cm broad; the first pair of leaflets(3-)4-7(-8) cm long by (0.5-)1.0-1.7(-2.8) cm broad. Pseudostipular leaves obliquely ovate to oblique and narrowly elliptic-lanceolate, 7-15 mm long. Inflorescence terminal or lateral, cymose, sublax, 12-15(-25)-flowered. Peduncle 10-15 cm long by 2 mm in dia. at base, glabrous, bifurcate or trifurcate; pedicels 15-20 mm long, very fine and slender, enlarging gradually toward the base of the calyx; articulated at the midpoint or near center, sometimes above center or slightly below center. Calyx generally asymmetrical 5.0-5.5 mm long, pale green or lightly pigmented, glabrous or subglabrous, lobes ovate-triangular to ovate-elliptic, apiculate. Corolla rotate-pentagonal (Fig. 79), usually small, 1.5-2.0(-2.8) cm in dia., white or white diffused with pale violet on the acumens, with a yellowish-green internal star. Staminal column truncate-conical; anthers pale yellow, 4.5 mm long, narrowly lanceolate; filaments 1 mm long, pubescent externally. Style 7-8 mm long, densely papillose along the basal one-third of its length; stigma capitate, very small, light green. Fruit long-conical, apex pointed, 20-25 mm long by 12-14 mm in dia. at base (Fig. 77), uniformly light green. Chromosome Number: 2n=24. EBN=2.

Local name: *Papa de Monte* in Pampasmayo, La Convención, Cusco.

Type: PERU. Department Cusco, Province La Convención, "El Dorado," 2900 m alt., 2-3 August 1943, C. Vargas C. 3504 (lectotype CUZ, here designated, isolectotypes LL, OCH).

Affinities

Solanum santolallae is related to *S. laxissimum*. The two are similar in leaf shape and dissection, and the pedicels are nearly identically articulated. However, *S.*

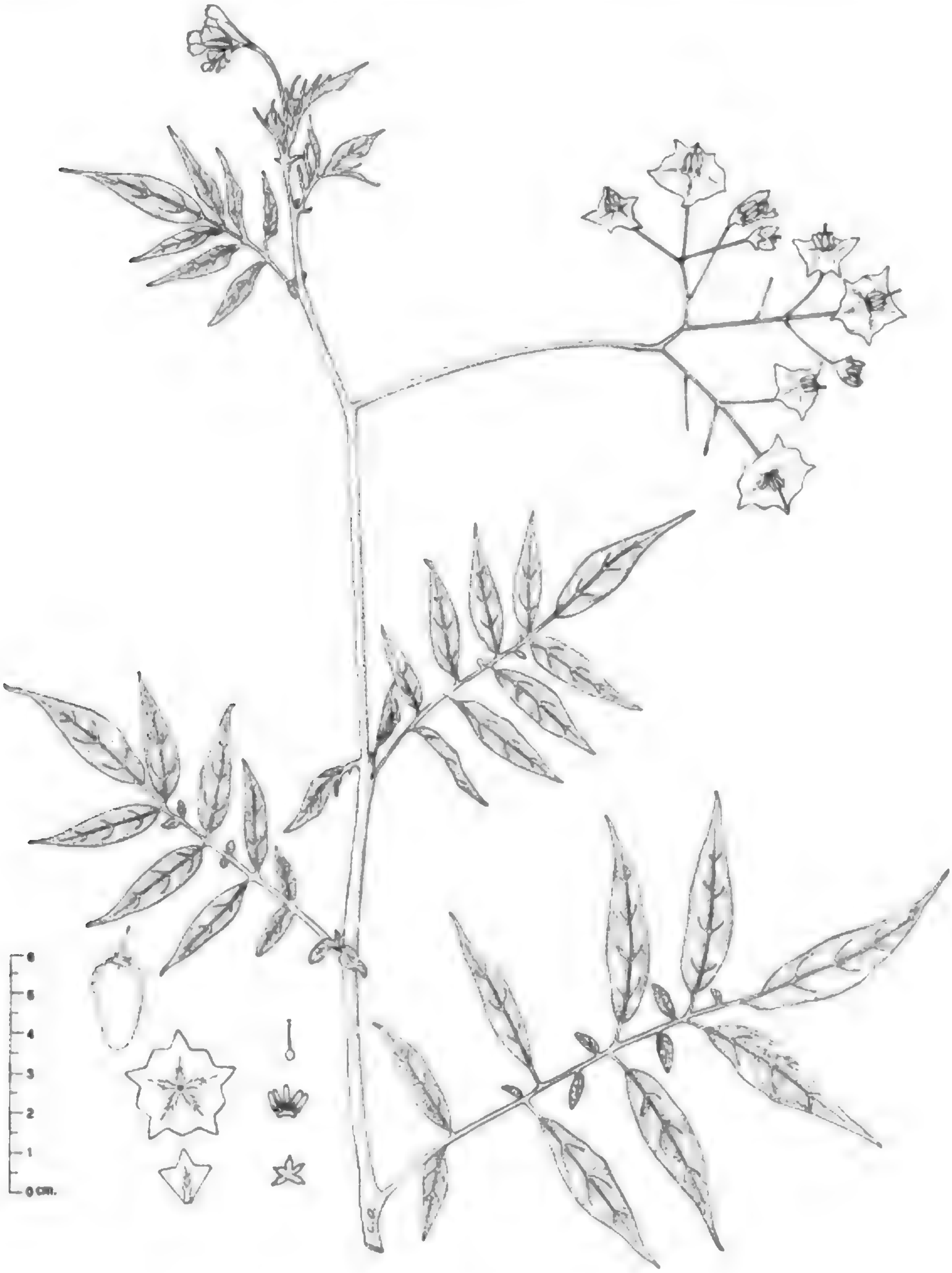


Figure 77. *Solanum santolallae* (*Ochoa 13628*, topotype).

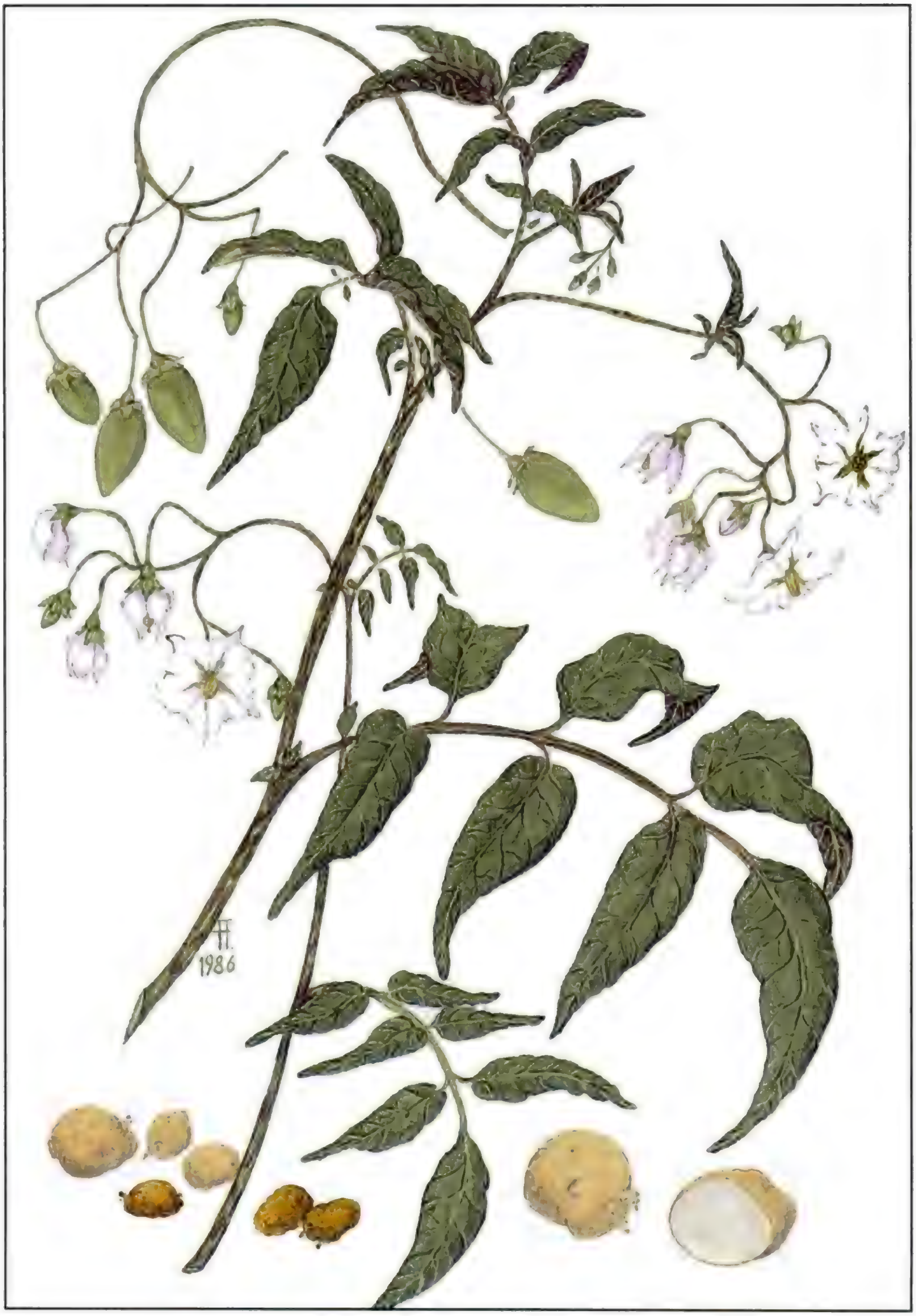


Plate VII. *Solanum santolallae* Vargas.

santolallae differs from *S. laxissimum* in having a weaker, less vigorous habit, leaflets that are more broadly lanceolate, a white corolla with very short acumens and smaller tubers of markedly different shape.

Habitat and Distribution

Solanum santolallae grows in the *Ceja de Montaña* and is associated with the very rich flora that is characteristic of that formation. It grows in thickets comprised of shrubs and herbs, in mountain clearings or deforested soils and along the

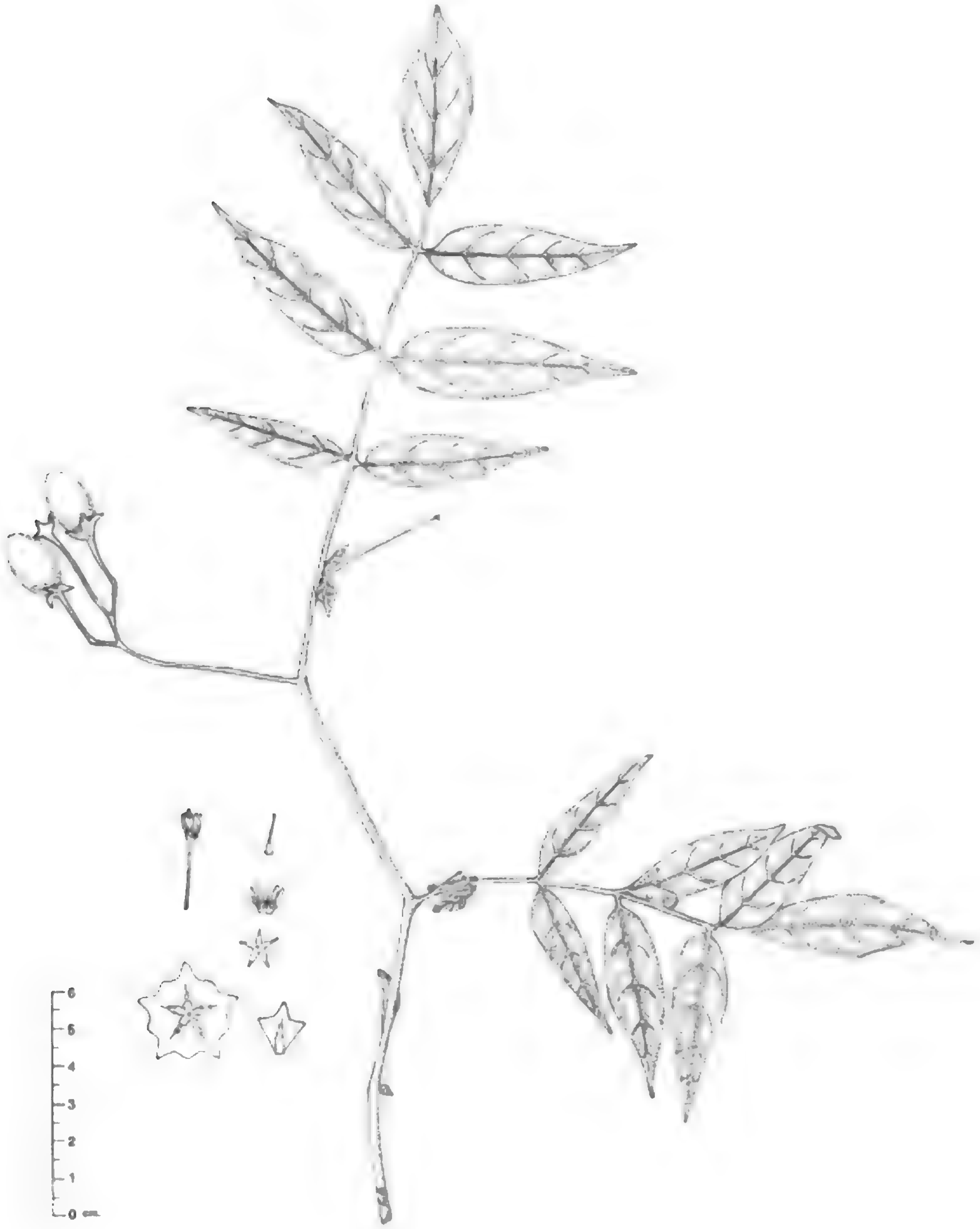


Figure 78. *Solanum santolallae* (*Vargas 3504*, type collection).

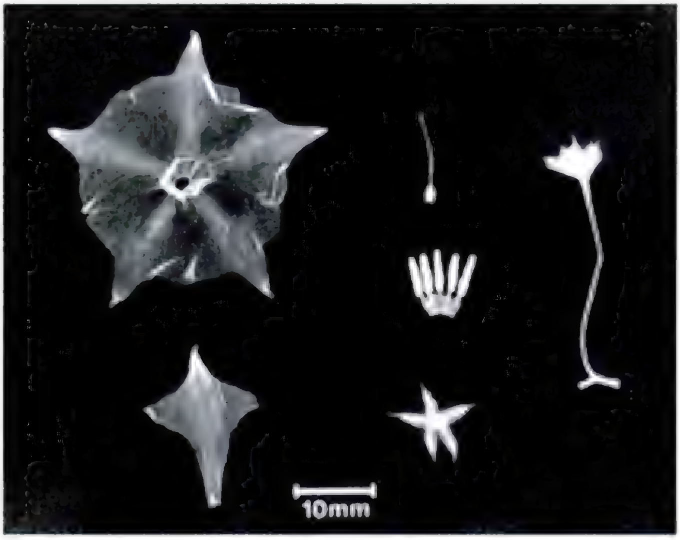


Figure 79. Floral dissection of *Solanum santolallae* (*Ochoa 13628*).

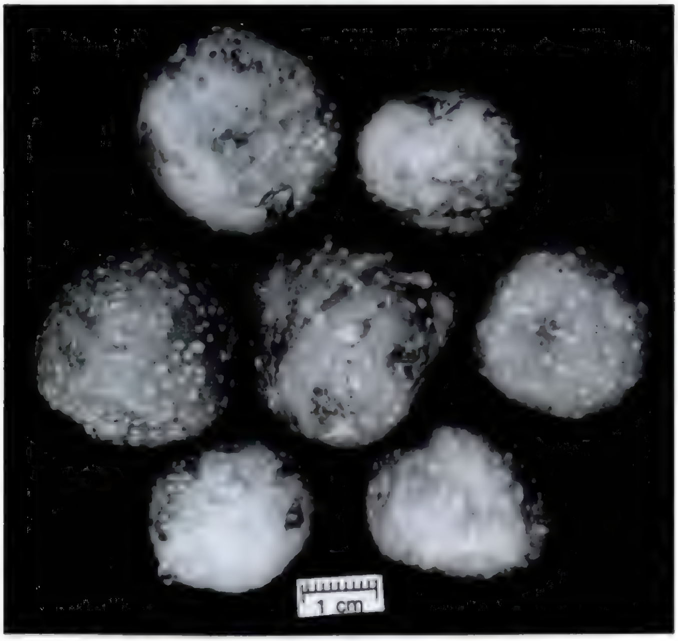


Figure 80. Tubers of *Solanum santolallae* (*Ochoa 15112*).

borders of tree forests near streams. In some places, it can be found growing with other wild tuber-bearing species such as *S. laxissimum* or *S. urubambae*. The range of this species, as far as is known, is restricted to the northeastern part of the Provinces of La Convención, Urubamba and Paucartambo in the Department of Cusco, in southern Peru, at elevations between 1800 and 3600 m (Fig. 81, Map 10).

Specimens Examined

Department Cusco

Province La Convención: El Dorado, 2900 m alt., plants 60-90 cm tall, flowers small, white or slightly pigmented blue, tubers ovoid, 2-3 August 1943, C. *Vargas* C. *3504* (CUZ, LL, OCH, type collection of *S. santolallae*). El Dorado, 2900 m alt., highlands of Pintobamba, in forest clearings, corolla light blue with white acumens, fruit conical, 5 August 1943, C *Vargas* C. *3505* (CUZ, CPC, OCH, type collection of *S. santolallae* var. *acutifolium*). Amaybamba, 1800 m alt., banks of a sandy river, January 1948, *F. Marin 859* (F). Lower slopes of Pampasmayo, 2500 m alt., origin of the Ccoribeni River, at edge of rain forest, among chonta trees, tree ferns, large colonies of *Chusquea* sp., many orchids and some begonias, flowers whitish-lilac, n.v. *Papa de Monte*, February 1980, C.

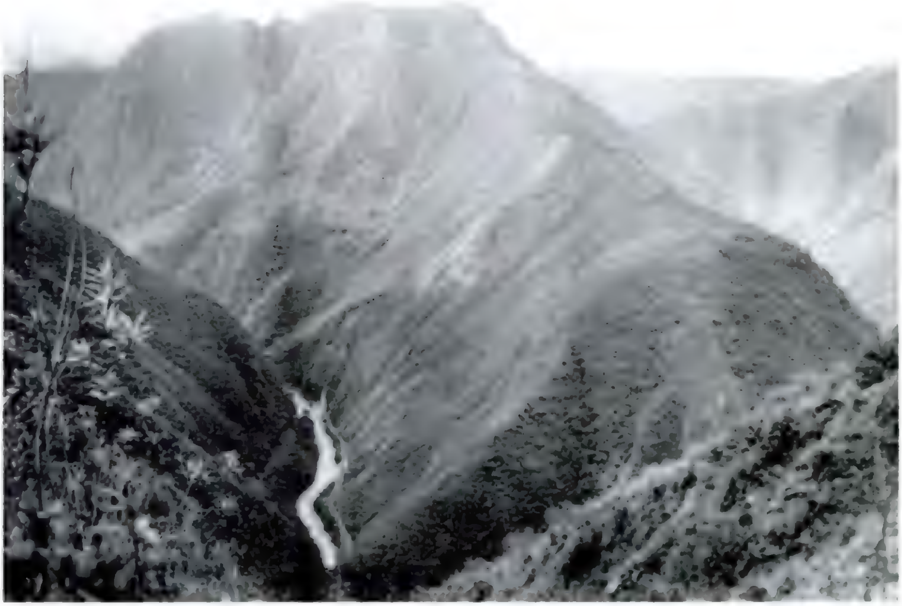
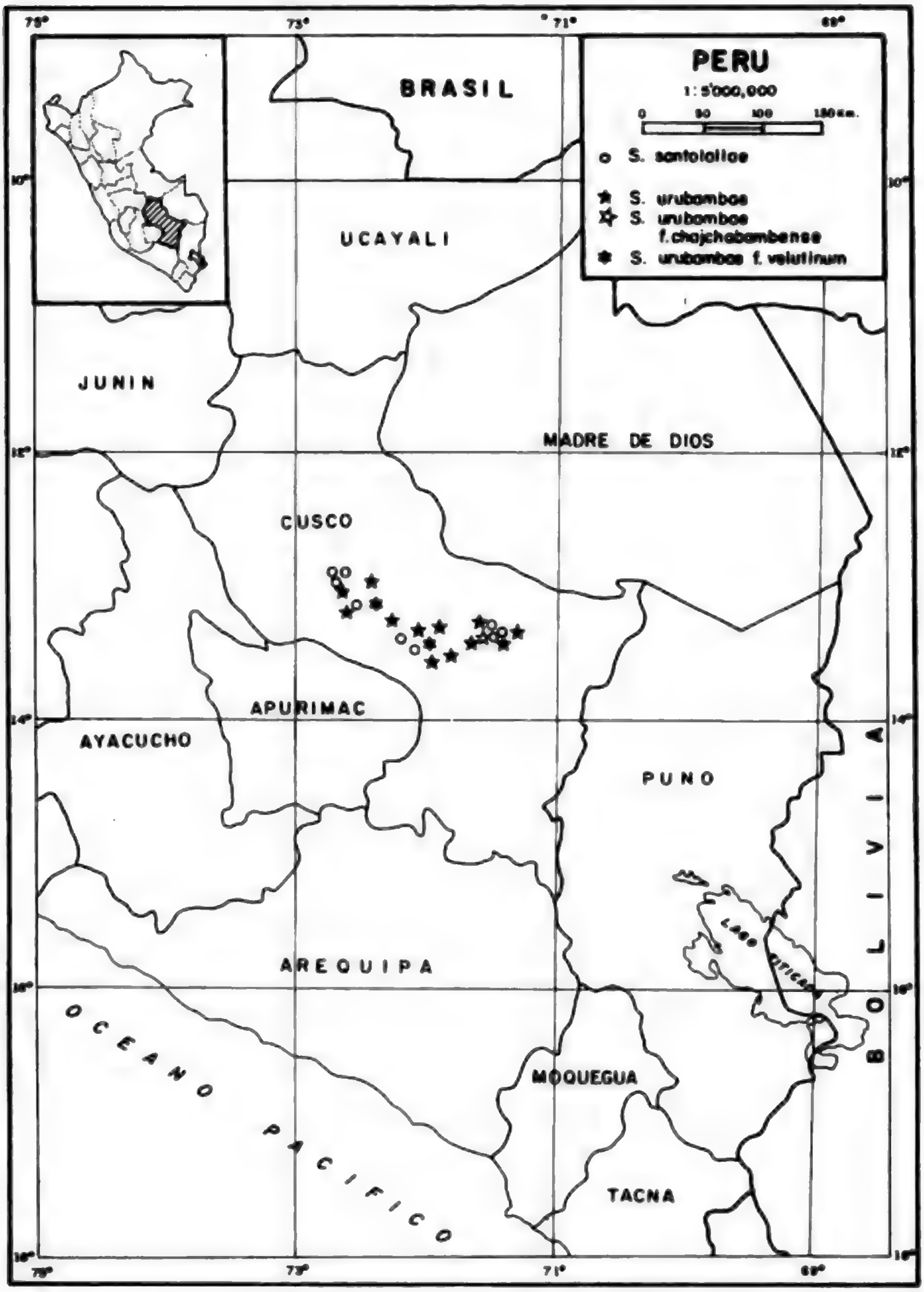


Figure 81. Canyon of the Urubamba near Machu Pikchu (2600 m alt.), habitat of *Solanum santolallae*.



Map 10. Distribution of *Solanum santolallae*, *S. urubambae*, *S. urubambae* f. *chakchabambense* and *S. urubambae* f. *velutinum*.

Ochoa 13627 (OCH). Sirinayocc, 2800 m alt., very near El Dorado, highlands of Pintobamba, along forest borders, flowers white with a light tint of lilac externally, February 1980, *C. Ochoa 13628*, 2n=24 (CIP, GH, MO, MOL, OCH, topotypes of *S. santolallae*).

Province Paucartambo: Cerro de K'usilluyokk, 3000-3300 m alt., Pillahuata, thicket in valley of paramo, climbing herb, corolla violet-purple, 3-6 May 1925, *F.W. Pennell 14117* (F, GH, PH). Acjanacu, 3600 m alt., Pillahuata, on hillsides in stony soil, 10-11 October 1943, *C. Vargas C. 3652* (CUZ, LL, OCH). Pillahuata, 2700 m alt., on open hillsides and mountain clearings in stony soil, corolla white, purple on the outside, fruit conical, the same as the type *Vargas 3504*, 9-10 May 1945, *C. Vargas C. 5109a* (CUZ, LL). Pilco, 3000-3100 m alt., among shrubs on mountain sides, flowers purple, 19-20 January 1953, *F. Woytkowski 315* and *338* (MOL).

Province Urubamba: Wiñay Wayna, [3000 m alt.], terraces above the city, 9-10 March 1944, *C. Vargas C. 4146* (CUZ, LL, OCH). Machu Pikchu, along an Inca trail leading from Sayacmarca to Palcay, 3580 m alt., aspect northwest, slope, very humid subtropical, mountain forest, 20 m from a stream, 21 May 1982, *B. Payton and S. Tilney Payton 311* (MO). Between Inti Punco and Wiñay Wayna, 2950 m alt., among dense forest trees and shrubs, 20-30 March 1983, *C. Ochoa 15112*, 2n=24 (CIP, OCH).

Table 17. Fertility of *Solanum santolallae* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	2	CONICIBACCATA	× *S. chomatophilum*	5(3)	5(1)	0(0)
			× *S. laxissimum*	13(11)	13(11)	178(162)
			× *S. limbaniense*	16	16	144
24	2	TUBEROSA	× *S. goniocalyx*	6(5)	6(1)	33(0)
24	2	YUNGASENSA	× *S. yungasense-2x*	7	5	0

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

The results of crosses involving *S. santolallae* are reported in Table 17, while the materials used for these experiments are given in Table 18.

As expected, no barriers to crossing appeared in reciprocal crosses of *S. santolallae* with *S. laxissimum*. These two species, being very closely related, yielded the highest average number of seeds per berry in reciprocal crosses. However, in reciprocal crosses involving *S. goniocalyx*, which is of the same ploidy and EBN as *S. santolallae*, success was obtained only when *S. goniocalyx* was used as the male parent. On the other hand, the reciprocal crosses of *S. santolallae* with *S. chomatophilum* (both of equal ploidy level and EBN) were not successfully achieved in either direction, while the unilateral crosses with *S. limbaniense* (2n=24 and EBN=2) were fully compatible. Lastly, no success was had in crosses of *S. santolallae* with *S. yungasense* (2n=24 and EBN=2).

Table 18. Collections (OCH) used in *Solanum santolallae* fertility studies.

CONICIBACCATA	TUBEROSA
S.chomatophilum 13205	*S. goniocalyx* 00001, 562-85
S. laxissimum 11855	
S. limbaniense 14291	YUNGASENSA
S. santolallae 13628	*S. yungasense-2x* 15041

19. ***Solanum urubambae*** Juz., Bull. Acad. Sci. U.S.S.R., 2:312-313, 1937. Figs. 82-88; Map 10; Plate VIII.

S. multiflorum Vargas, *Las Papas Sudperuanas*, Part I (Publ. Univ. Nac. Cusco):93, Fig. 37, 1949 (as *S. multiflorae*) *nom. nud.*; Part II:55, 1956. type: PERU, Dept. Cusco, Prov. Calca, hacienda Vilcabamba, on the right bank of the Yabero River or Paucartambo, among shrubs, at the edge of a stream, 7 January 1944, *C. Vargas C. 4062* (CUZ, LL, OCH).

S. villuspetalum Vargas, *Las Papas Sudperuanas*, Part I (Publ. Univ. Nac. Cusco):92, Fig. 36, 1949 (as *S. villuspetala*); Part II:54, 1956. Type: PERU, Dept. Cusco, Prov. Urubamba, Wiñay Wayna, "Terraces of the City," 2500 m alt., 9-10 March 1944, *C. Vargas C. 4131* (CUZ, LL, OCH).

Plant robust, erect-ascending to erect-decumbent, 0.5-3.0 m tall. Stem vigorous, 0.5-2.5 cm in dia. at base, simple or with many flowering branches, straight or somewhat flexed, cylindrical, wingless, somewhat striated, light green or flecked purple-violet in the basal two-thirds of its length, sparsely covered with hairs to densely puberulent or tomentose; internodes 1-7 cm to 11-15 cm long. Stolons 2 m or more long, partially purple and partly white, thick, 7 mm in dia.; tubers generally ovoid or thick and pyriform, slightly compressed, (4-)8-10 cm long, whitish-yellow, with numerous lenticels, eyes superficial, flesh white (Fig. 87). Leaves imparipinnate, rarely simple, with 1-3(-4) pairs of leaflets,

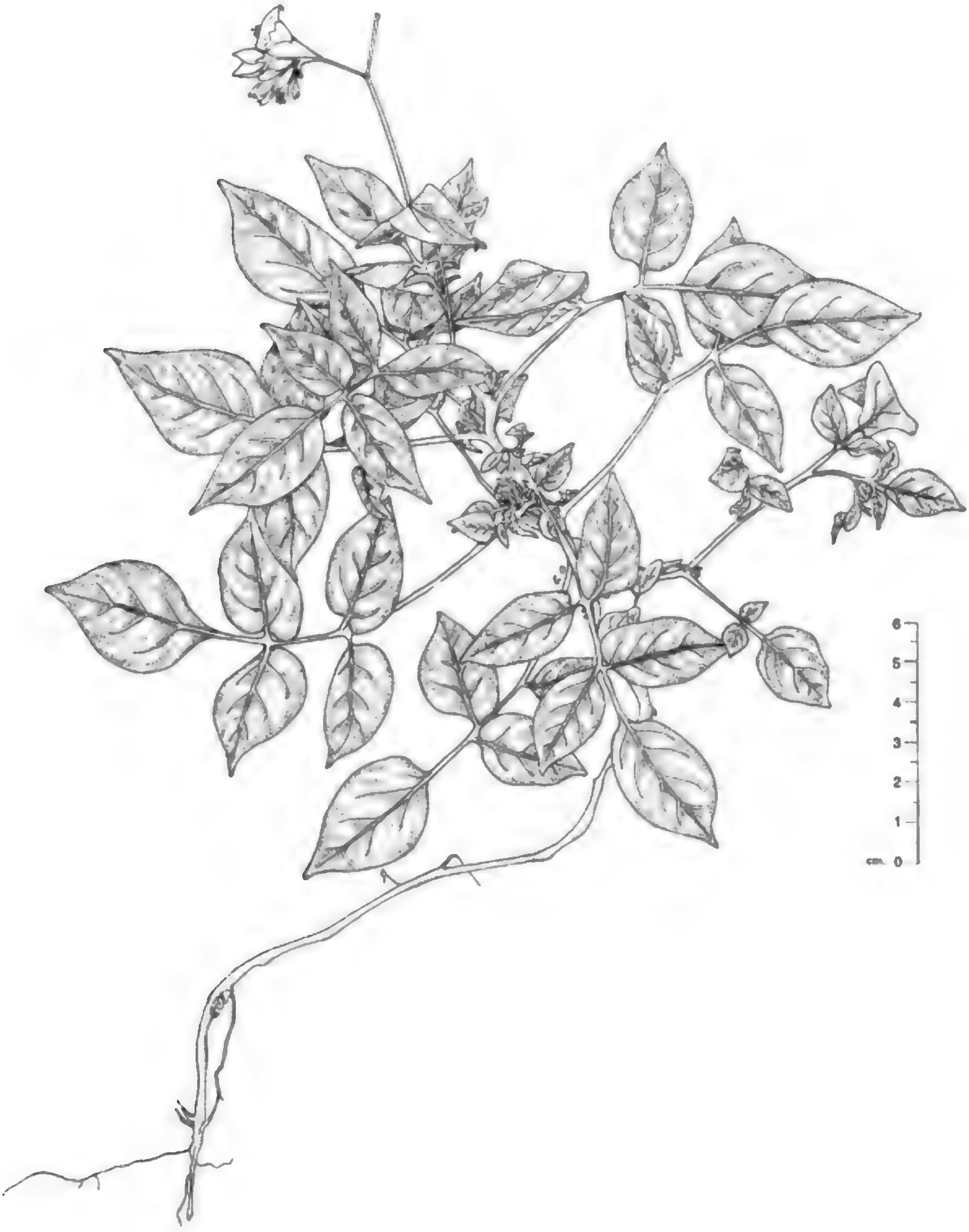


Figure 82. *Solanum urubambae* (*Juz.* 10973, type).

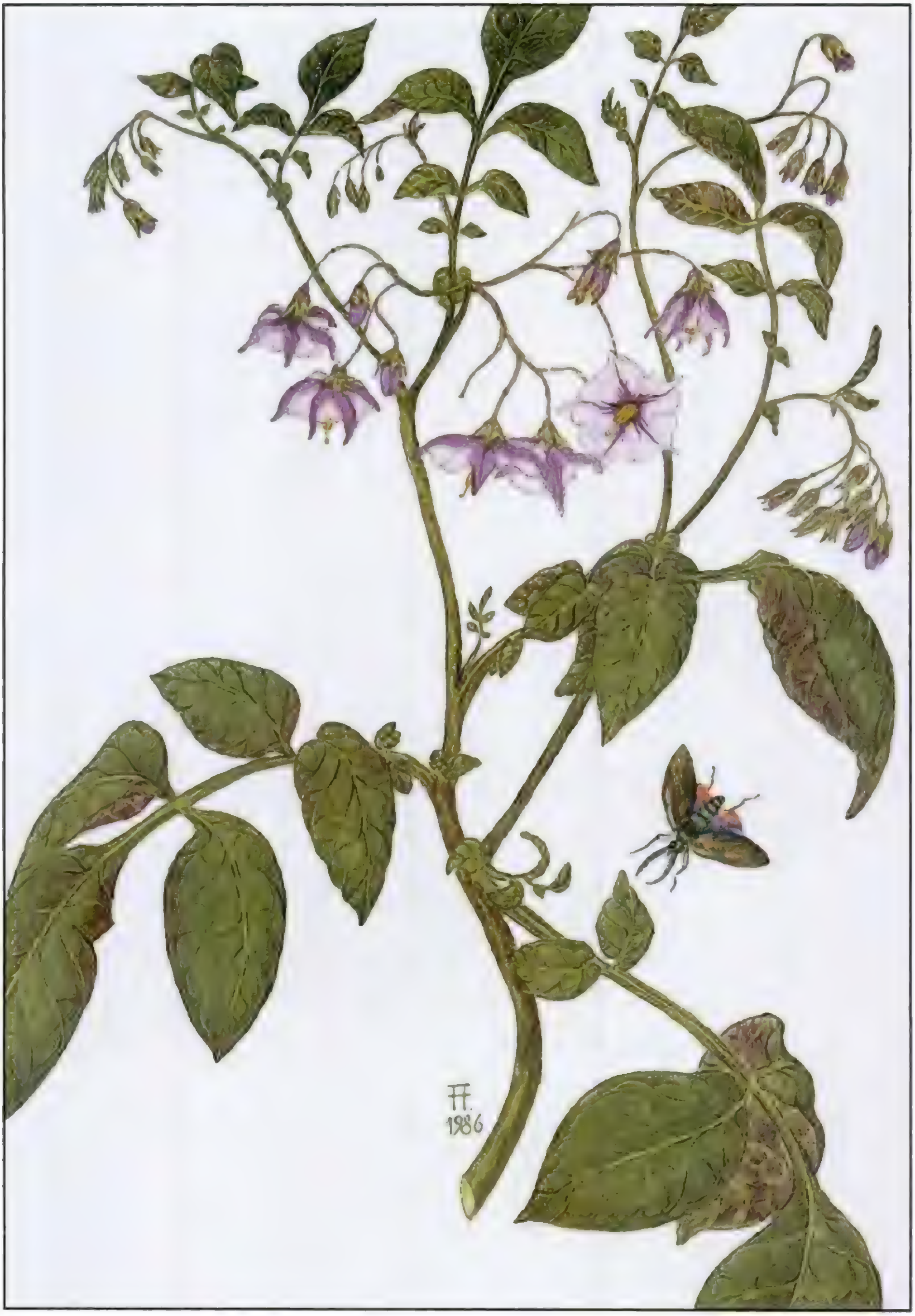


Plate VIII. *Solanum urubambae* Juz.

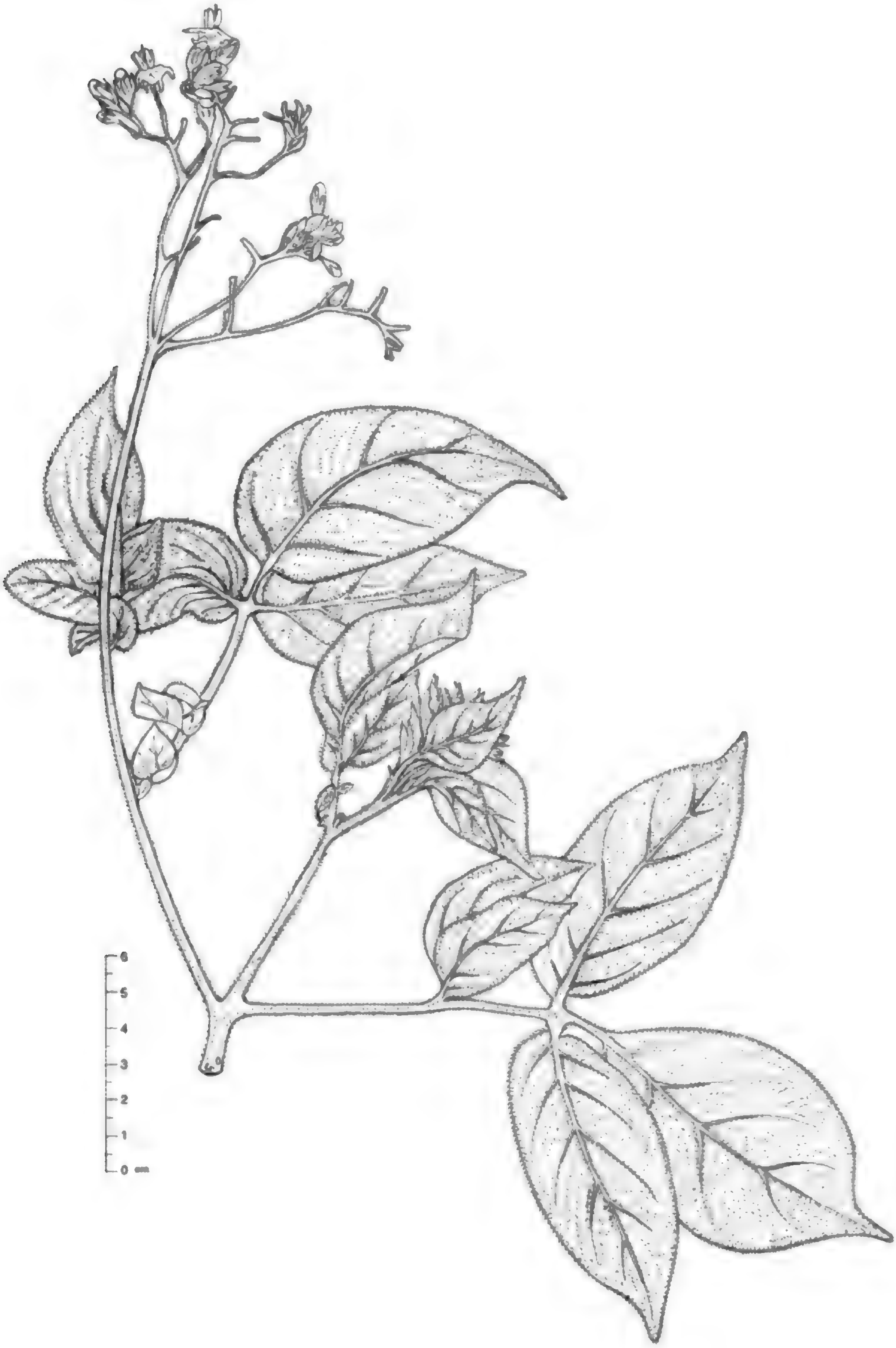


Figure 83. *Solanum urubambae* (*C. Vargas C. 4131*).

(5.0)14.0-30.0(-40.5) cm long, including the petiole, by (3.5-)10.5-20.5(-34.0) cm broad, with 0-1(-2) pairs of interjected leaflets, on petioles 4-7(-14) cm long, dark green (or sometimes somewhat brilliant), densely pilose to velvety above, lighter green and very pilose below, with pilose margins, hairs simple, adpressed or subadpressed, silky, puberulent or tomentose, varying to yellowish-velutinous or whitish-yellow to whitish, with intermixed, small, glandular tetralobular hairs principally on the rachis, the petioles and the axils. Terminal leaflet larger than the laterals, (3.5-)6.5-15.0(-19.5) cm long by (2.0-)4.0-6.0(-7.5) cm broad, broadly ovate to obovate, the apex shortly acuminate and the base subcordate to rounded or attenuate, very narrowly decurrent about the petiolule; lateral leaflets broadly

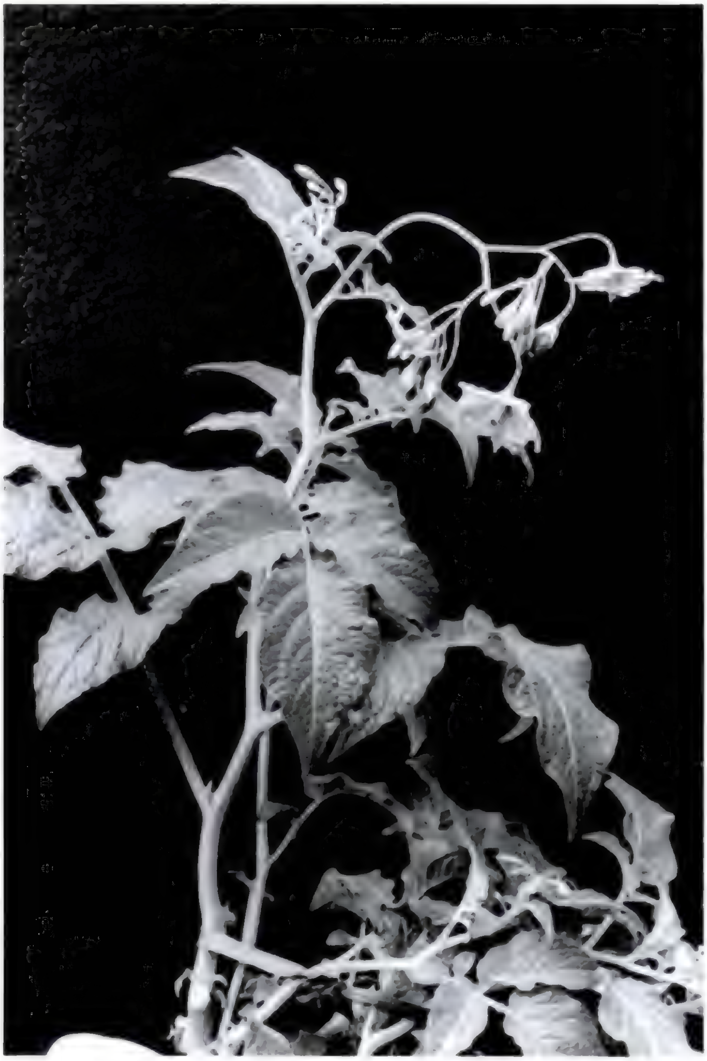


Figure 84. *Solanum urubambae* Juz., *ca.* × 1/4 (photo by C. Ochoa).

elliptic to elliptic-lanceolate, the apex abruptly pointed to shortly acuminate and the base obliquely rounded or slightly cordate, on petiolules 2-3(-6) mm long; the first pair of lateral leaflets (2.5-)5.5-10.0(-12.0) cm long by (1.5-)2.6-5.0 (-5.5) cm broad; in the leaves having 3-4 pairs of leaflets, the lowermost pair of leaflets is much smaller than the uppermost ones, but when there are only 2 pairs of laterals, the lowermost pair is nearly equal in same size to the upper pair. Interjected leaflets, when present, suborbicular, sessile, 3-5 mm long. Pseudostipular leaves semi-ovate or narrowly semi-elliptic to slightly falcate, 0.9-2.0 mm long by 5-8 mm broad. Inflorescence pseudoterminal or lateral, cymose-paniculate or cymose, lax, very floriferous, (15-)25-45(-80)-flowered, or more. Peduncle vigorous, (5-)10-14 cm long, densely pubescent, forked two or three times; pedicels 15-20 mm long, slender, puberulent or very shortly and densely pilose, hairs simple, mixed with glandular hairs, articulated below center or about 9-12 mm below the base of the calyx. Calyx asymmetrical, 5-7 mm long, pilose, lobes elliptic or broadly semi-ovate to ovate-subquadrate, the apex abruptly apiculate or attenuate to short acumens. Corolla rotate-pentagonal, 2.5-3.0 cm in dia., usually lilac or violet-lilac, less frequently pale violet or bluish-purple; lobes short with prominently long acumens and a narrow base (Fig. 85). Staminal column cylindrical or cylindrical-conical, the apex obtuse and compact, anthers

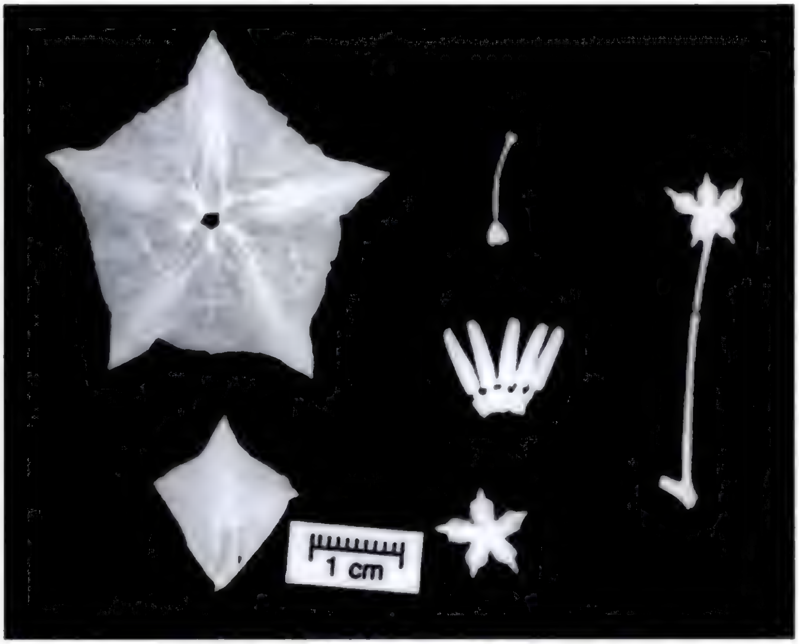


Figure 85. Floral dissection of a specimen of *Solanum urubambae* from Pajcha, Cusco (*Ochoa 13614*).

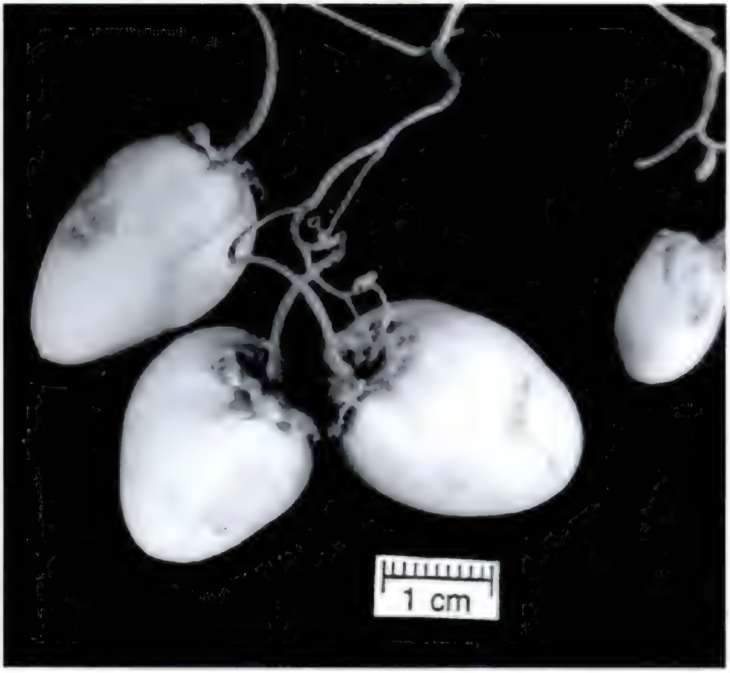


Figure 86. Berries of *Solanum urubambae* (*Ochoa 13778-A*).

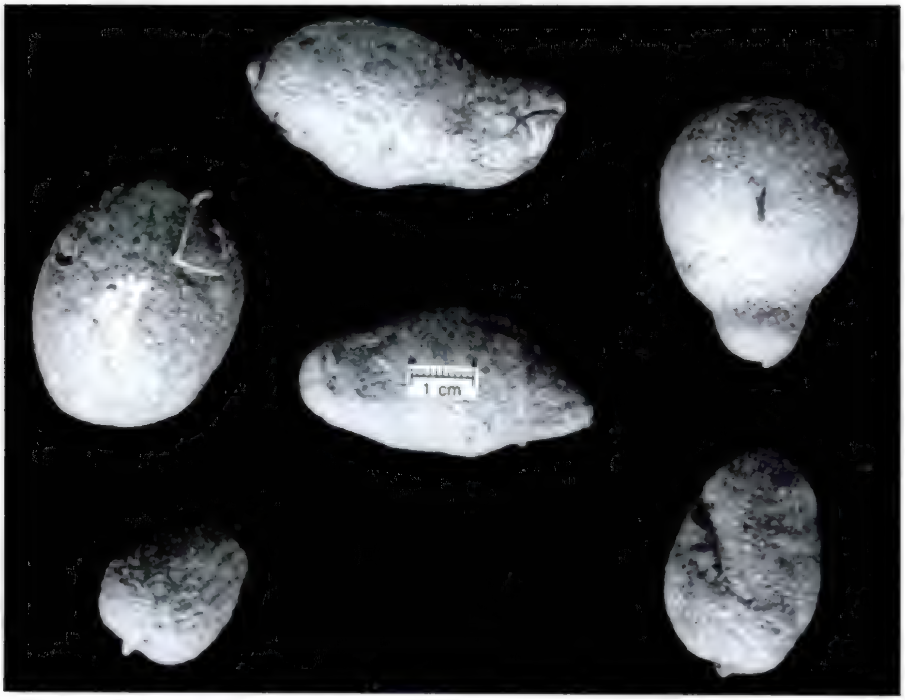


Figure 87. Tubers of *Solanum urubambae* (*Ochoa 13614*).

yellow or pale yellow, narrowly lanceolate to linear-lanceolate, (5.5-)7.0-8.5 mm long; filaments short, less than 1 mm long, pilose. Style 8.5-10.0 mm long, very slender or filiform, densely papillose in the lower one-third of its length; stigma ovoid, less than 0.5 mm long. Ovary long-conical to oval-conical, the apex sometimes pale lilac. Fruit long-conical to oval-conical, the apex sub-pointed to obtuse, light green, 1.5-2.0 cm long by 1.4 cm in dia. at base (Fig. 86). Chromosome Number: 2n=24. EBN=2.

Local Names: *Papa del Inca* in Cedrobamba, Province Urubamba and in Paucartambo; *Papa de Monte* in Vilcabamba, Province La Convención.

Type: PERU. Department Cusco, Province Urubamba, between Santa Rita and Ckellumayo, in the Urubamba River Valley, growing among stones, 31 July 1927, *S. Juzepczuk 10973* (lectotype LE, designated here, isolectoype OCH).

Commonly, plants of *S. urubambae* will not develop stems greater than about 50-60 cm in length when they are growing in open fields or in poor, rocky soil. However, when growing in soils rich in humus, as well as in lush thickets or along the edges of forest formations, plants of this species may develop robust, branching stems 3 m or more in height bearing numerous flowers. Environmental differences also play a part in the degree of development of the plant's indumentum, or hairy covering. In some ecotypes, as in the case of *S. villuspetalum* (*Vargas 4131*; see Fig. 83), the leaf blades, petioles, petiolules and stem are densely pilose; whereas in others, as for example in the topotype collected by Ochoa (No. *13788*), there is far less pilosity. Again, this is borne out in comparisons of *S. urubambae* (*Juzepczuk 10973*; see Fig. 82) with *S. multiflorum* (*Vargas 4062*).

An unusual case involving the development of the pilosity of the leaves and their overall form is described a bit later in this work under the new name combination *Solanum urubambae* f. *velutinum*. Similarly, a new taxon, *S. urubambae* f. *chakchabambense*, which is based upon certain floral differences (including the color and shape of the corolla) and tuber characteristics, is presented later.

A character extremely important in *S. urubambae* is the conspicuous pubescence which covers the entire plant. However, this pilosity is not only of variable density but the hairs which comprise it may be of unequal length. Different collections of *S. urubambae* may vary in hairiness from densely puberulent, as in the case of the type plant (*Juzepczuk 10973*) to tomentose, as in the majority of the specimens examined. Still others vary from velutinous to villous, as for example in the type collections of *S. villuspetalum* (*Vargas 4131*) and *S. santolallae* var. *velutinum* (*Correll and Smith P261*).

It is also important to note that while the color of the flower (according to collector notes) varies from a deep violet-lilac to a blue-violet, the corolla is essentially a lilac color or a pale violet-lilac color. Moreover, although the corolla lobes are very short, the acumens are prominently long and narrowly triangular-lanceolate, giving it therefore the appearance of a rotate-pentagonal corolla, or at times of a substellate corolla.

Affinities

Solanum urubambae is more closely related to *S. pillahuatense* than to any other species. Both grow in the *Ceja de Montaña*, and both are characteristically very pubescent and have conspicuously long-petioled and poorly dissected leaves as well as rather similar-appearing leaflets. However, the stems of *S. pillahuatense* rarely grow over 80 cm tall, even when the plants occur in dense thickets or shrub forests. Moreover, this species differs from *S. urubambae* in having an erect inflorescence that bears far fewer flowers, pedicels that are articulated near the midpoint or in the upper one-third of their length (but never below the center), shorter anthers, consistently glabrous filaments, and oval-conical fruits.

Though related to *S. pillahuatense*, *S. urubambae* appears also to retain some affinity to the Bolivian *S. violaceimarmoratum*. The two are similar in having tall, vigorous stems, strongly acuminate leaf apices and rotate-pentagonal corollas. Moreover, both are inhabitants of the subtropical selva. They differ, however, in several important ways. For example, in *S. violaceimarmoratum* the indumentum is less developed over the entire plant, the stem is winged and glabrous or glabrescent, the leaves are more divided and the corolla is purple with whitish acumens.

Lastly, it should be pointed out that *S. urubambae* also holds some features in common with another Bolivian species of the subtropical selva, *S. bombycinum*. The leaves of both species are of similar shape and dissection, and both may have forms that are densely pubescent. However, unlike *S. urubambae*, the Bolivian species is tetraploid ($2n=48$).

Habitat and Distribution

Solanum urubambae is a member of the *Ceja de Montaña*. It grows preferentially among such common mountain trees as *Alnus*, *Cecropia*, *Cedrela*, *Juglans*, *Inga*, *Magnolia* and *Myrica*, or shrub forest and herbaceous thicket plants as *Adiantum*, *Calceolaria*, *Cleome*, *Chusquea*, *Desmodium*, *Fuchsia*, *Iris*, *Lupinus*, *Monnina*, *Oxalis*, *Piper*, *Salvia* and *Stelis*, various species of grasses, herbaceous and tree ferns, many orchids, as for example *Masdevalia veitchi*, *Epidendrum*,

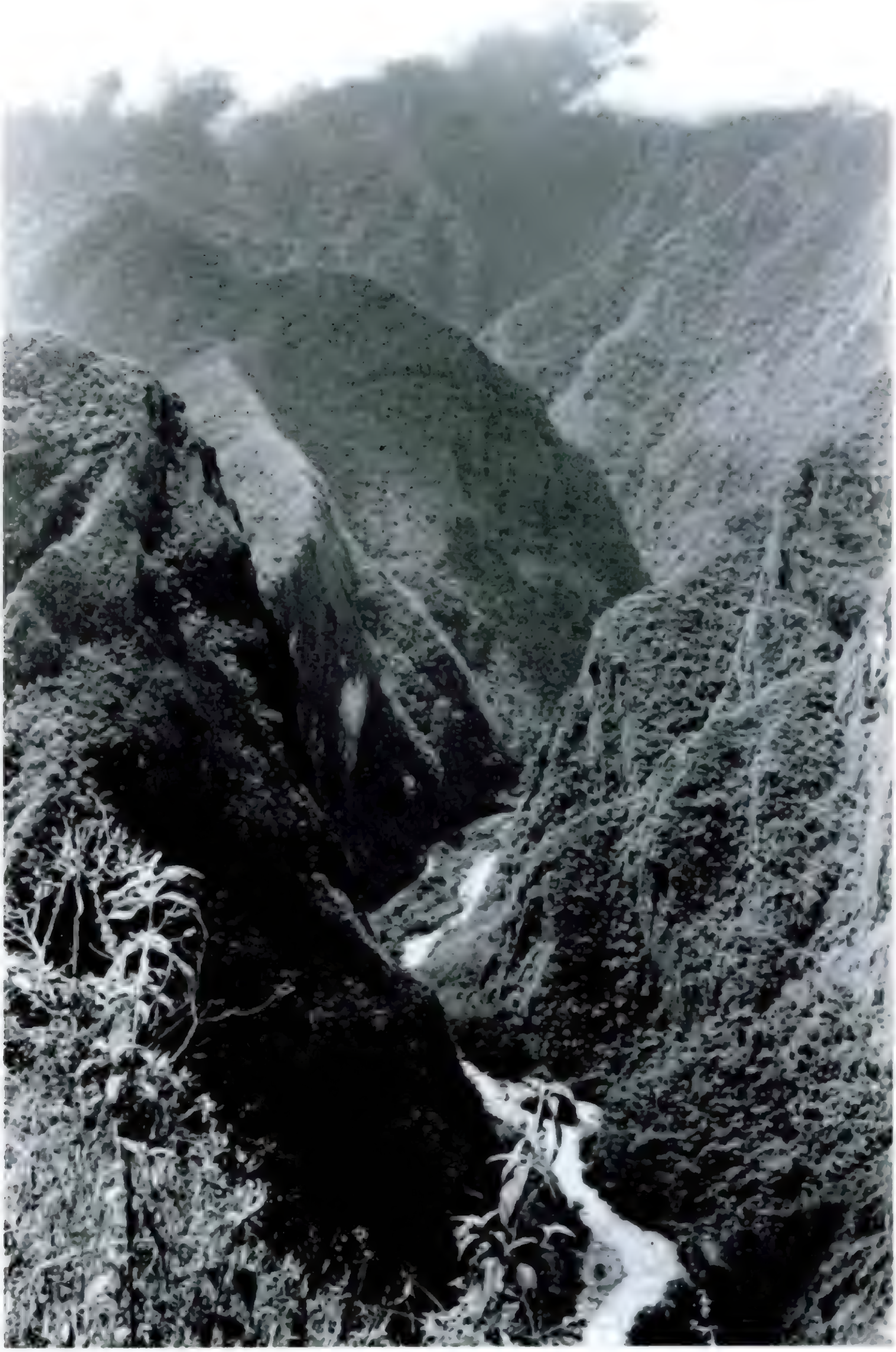


Figure 88. Canyon of the Urubamba, habitat of *Solanum urubambae*.

etc., and many composites, melastomes, mosses, lichens and ericads. This species has been reported to grow in stony soils, open fields and humus filled rock hollows. It has been collected in the southern parts of its range and at Machu Pikchu with two other tuberous members of this genus, *S. santolallae* and *S. laxissimum*.

Solanum urubambae is known only from the Provinces of Calca, La Convención, Paucartambo and Urubamba in the the Department of Cusco, Peru, where it preferentially grows at altitudes ranging between 2000 and 2900 m (or very exceptionally between 3000 and 3400 m) Map 10.

Specimens Examined

Department Cusco

Province Calca: Hacienda Vilcabamba, 2700 m alt., on the left bank of the Yavero River or Paucartambo, amid trees, plants to 3 m tall, 7 January 1944, C *Vargas C. 4062* (CUZ, LL, OCH, type collection of *S. multiflorum*). Between Mant'tu and Cho'cke Cancha, 2500 m alt., between Amparaes and Quebrada Honda, following a bend of the Yanatili River, among forest trees and woody shrubs represented principally by *Chusquea* and *Piper,* many composites and some non-tuber bearing *Solanums*, 22 March 1980, *C. Ochoa 13793*, 2n=24 (CIP, OCH).

Province La Convención: Palmayok, near Vilcabamba, 2600 m alt., plant without flowers, April 1975, *O. Blanco s.n.* (OCH). Cedromayo, without flowers, April 1975, *O. Blanco s.n.* (OCH). Tarqui, heading up to Vilcabamba, 2200 m alt., April 1975, *O. Blanco s.n.* (OCH). Hacienda La Negrilla, 3000 m alt., near Vilcabamba, April 1975, *O. Blanco s.n.* (OCH). Millpo, 2900 m alt., above Ccollpapampa, plants still very young, 13-15 February 1980, *C. Ochoa 13613* (CIP fragment, OCH). Pajcha, 2800 m alt., between Ccollpapampa and Wiñay Pukio, among forests and scrub *(Alnus* sp., begonias, orchids, fuchsias, etc.), 13-15 February 1980, *C. Ochoa 13614* (CIP, OCH, US), *13614A* (CIP, USM, from plants propagated at Huancayo) and *13614B* (CIP, MOL, US, from plants propagated at La Molina, Lima). Wiñay Pucyo, 2600 m alt., amid *Alnus* trees and shrubs of *Sambucus,* near cornfields, flowers lilac, February 1980, *C. Ochoa 13617* (CIP, OCH). Between Ccollpapampa and Totora, heading up to Totora, 2800 m alt., amid *Chusquea* sp. and *Alnus* trees, March 1980, *C. Ochoa* 13778 (CIP, MOL, OCH, US, USM) and *13778A* (CIP, MO, MOL, OCH, US, from plants propagated at Huancayo). Between Pajcha and Wiñay Pucyo, 2700 m alt., along forest margins, corolla rotate-pentagonal, lilac, March 1980, *C. Ochoa 13779* (CIP, GH, MO, MOL, OCH, US, USM) and *13779A* (CIP, MO, MOL, OCH, US, USM, from plants propagated at Huancayo). Churubamba, 2500 m alt., flowers lilac, berries long-conical, March 1980, *C. Ochoa 13781*, 2n=24 (CIP, GH, MOL, OCH, US, USM), and *13781A* (CIP, GH, MOL, MO, OCH, US, USM). Lluscamayo, 2500 m alt., heading up to Yanama, flowers light violet, leaves little divided, March 1980, *C. Ochoa 13782*, 2n=24 (OCH). Sillani, 2500 m alt., near Churubamba, tubers large some 8 cm in length, March *1980, C. Ochoa 13784* (OCH). Atocsaicu, 3400 m alt., heading up the summit of Yupanca, near Vilcabamba, protected by spiny shrubs, associated with other non-tuber bearing *Solanums*, March 1984, *C. Ochoa 15647* (CIP, MOL, OCH, US, USM) and *15647A* (MOL, OCH, from plants propagated at Huancayo). Cuncurchaca, 3000 m alt., between Huancacalla and Vilcabamba, among large colonies of *cuncur* (= *Chusquea* sp.), March 1984, *C. Ochoa 15650*, 2n=24 (CIP, GH, MO, MOL, OCH, US, USM). Yupanca, 2750 m alt., near the Salinas River, heading up to Vilcabamba, among *Chusquea* sp., 18 March 1984, *C. Ochoa 15652*, 2n=24 (CIP, MO, MOL, OCH, USM). Palmayok, 2600 m alt., right bank of the Palmayok River, along the margins of cornfields and enclosures of *Chusquea,* stems cylindrical, March 1984, *C. Ochoa 15654*, 2n=24 (CIP, OCH, US, USM). Tarqui, 2200 m alt., near the Tarqui River, among thicket shrubs associated with herbs, *Oxalis, Salvia,* various grasses and composites, plants to 2 m tall, n.v. *Papa de Monte,* March 1984, *C. Ochoa 15657*, 2n=24 (CIP, MOL, OCH, USM).

Province Paucartambo: Cerro Cusilluyoc, 2300-2500 m alt., in forest, corolla violet, anthers yellow, 3-6 May 1925, *F.W. Pennell 13955* (F, NY, PH, US). Pilco, *ca.* 3100 m alt., flowers dark purple, on low mountain, n.v. *Papa del Inca,* 10 January 1953, *D. Woytkowski 295* (MOL). Puyupata, 3400 m alt., February 1953, *F. Woytkowski 440 p.p.* (MOL). Puyupata, Callanga, 3400 m alt., in low forest, flowers purple, 16 March 1953, *F. Woytkowski 575* (MOL). Arrayanniyoc, 2600 m alt., above Totora, Distr. of Challabamba, very scarce, 23 February 1980, *C. Ochoa 13646* (CIP, MOL, OCH, USM).

Province Urubamba: Between Santa Rita and Ckellumayo, on stony ground, 31 July 1927, *S. Juzepczuk 10973* (LE, OCH, type collection of *S. urubambae*). Wiñay Wayna, 2500 m alt., terraces of the city, plants to 1 m tall, corolla dark blue, 9-10 March 1944, *C. Vargas C. 4131* (CUZ, LL, OCH, type collection of *S. villuspetalum*). At km 104 of the Santa Ana railroad, along the length of the railway, 2100 m alt., plant 1.20 m tall, corolla sky-blue, 9-10 March 1944, *C. Vargas C. 4158* (CUZ, LL, OCH, topotypes of *S. urubambae fide* Vargas). Salapunco, 2500 m alt., on stones, 14 March 1949, *C. Vargas C. 8107* (CUZ, LL). Pampackawua, 2100 m alt., on stony ground, 21 April 1959, *C. Vargas C. 12777* (WIS). Above the ruins of Machu Pikchu, 2750 m alt., 21 February 1960, *C. Ochoa 2206* (OCH). Vicinity of Cedrobamba, 2000 m alt., near Machu Pikchu, 22 February 1960, *C. Ochoa 2207*, 2n=24 (MOL, OCH, US, USM). Ruins of Machu Pikchu, valley of río Urubamba, 2550-2800 m alt., on Inca road to Cusco, between ruins and small pass, with *Cleome lechleri,* many terrestrial orchids, bamboos, *Monnina,* ericads, etc., 3 January 1963, *H.H. and C.M. Iltis, D. and V. Ugent 1094* (OCH, WIS). Ruins of Machu Pikchu, valle of río Urubamba, SW-facing steep, lower slope of Machu Pikchu mountain, *ca.* 1-2 km E of Machu Pikchu ruins, 2550-2800 m alt., in heavily disturbed more or less xerophytic rocky slopes on Inca road to Cusco, between ruins and small pass with *Cleome lechleri,* many terrestrial orchids, bamboo, *Monnina,* ericads, Inca road 1 km east of Machu Pikchu, 3 January 1963, *H.H. and C.M. Iltis, D. and V. Ugent 1095* (US). About 1.5 km southwest of Machu Pikchu, 2800 m alt., heading up from the ruins toward the third gate of the ancient Inca road, between large tufts of bamboo, orchids and begonias, 19 March 1980, *C. Ochoa 13787*, 2n=24 (OCH). Wiñay Wayna, 2550 m alt., between the rock crevices of the terraces and ruins of the city, 19 March 1980, *C. Ochoa 13788*, 2n=24 (CIP, OCH, topotype of *S. villuspetalum*). Near Intipunco, 2900 m alt., in a hollow formed by large rocks, between Machu Pikchu and Wiñay Wayna, very scarce, without flowers or fruit, March 1983, *C. Ochoa 15111* (OCH). Ruins of Machu Pikchu, near the Inca bridge, 2800 m alt., flowers violet, very much infected with *Phytophthora infestans*, March 1983, *C. Ochoa 15113* (OCH). Cedrobamba, 2300 m alt., near Machu Pikchu, along the margins of forests formed principally by *Juglans*, *Myrica*, *Inga*, *Cecropia* and *Cedrela*, etc., plants very vigorous up to 2 m tall with ovoid to oval-flattened tubers, light brown, large, 10-12 cm in length, 13 March 1984, *C. Ochoa 15638*, 2n=24 (CIP, MOL, OCH, USM). Lower terraces of the archaeological complex of Wiñay Wayna, 2500-2600 m alt., among forest shrubs and thicket herbs (ferns, begonias, orchids and others), 20 March 1984, *C. Ochoa 15658*, 2n=24, topotype of *S. villuspetalum* (CIP, MOL, OCH). Vicinity of the Inca bridge, *ca.* 2500 m alt., near the ruins of Machu Pikchu, tubers long subcylindrical or flattened, 3-4 cm long, white, 20 March 1984, *C. Ochoa 15659*, 2n=24 (CIP, MOL, OCH). Near Santa Rita, 2300 m alt., canyon of the Urubamba, in lush tropical vegetation (*Inga*, *Cedrela*, *Cecropia*, *Begonia*, *Fuchsia*, *Monnina*, *Calceolaria* and many orchids), March 1984, *C. Ochoa 15662*, 2n=24 (topotype of *S. urubambae* OCH).

Table 19. Fertility of *Solanum urubambae* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	2	CONICIBACCATA	× *S. laxissimum*	154(6)	73(3)	5(5)
24	2	TUBEROSA	× *S. bukasovii*	30	28	35
			× *S. coelestispetalum*	65(14)	39(11)	40(97)
			× *S. marinasense*	63(2)	46(2)	40(113)
			× *S. phureja*	15(4)	9(4)	67(29)
			× *S. saxatilis*	7(3)	0(0)	0(0)
			× *S. stenotomum*	7	0	0
24	1	LIGNICAULIA	*S. urubambae* f. *velutinum* × *S. lignicaule*	8	6	0
24	2	CONICIBACCATA	*S. urubambae* f. *velutinum* × *S. laxissimum*	6	6	75
24	2	TUBEROSA	*S. urubambae* f. *velutinum* × *S. medians-2x*	8	6	0

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

The results of crosses made with *S. urubambae* are given in Table 19, while the materials used for these experiments are shown in Table 20. *Solanum urubambae* is self-incompatible.

Reciprocal crosses of this species with *S. laxissimum*, another diploid species of series Conicibaccata having EBN=2, were in effect non-compatible. Despite numerous pollinations, the crosses yielded only few seeds, and these were found to be non-viable. However, the unilateral cross of *S. urubambae* f. *velutinum* with *S. laxissimum* yielded a fairly high average number of seeds per berry. Similarly, reciprocal crosses of *S. urubambae* with *S. coelestispetalum*, *S. marinasense* and *S. phureja*, all of series Tuberosa (2n=24) and EBN=2, were all fairly successful, yielding a high average number of well-formed and fertile seeds. But, reciprocal crosses of this species with *S. saxatilis* (2n=24 and EBN=2) of series Tuberosa, were unsuccessful, as were the unilateral crosses with *S.*

stenotomum and *S. medians* of series Tuberosa and *S. lignicaule* of the series Lignicaulia. The unilateral cross of *S. urubambae* with *S. bukasovii* (2n=24 and EBN=2) of the series Tuberosa, however, did succeed.

Table 20. Collections (OCH) used in *Solanum urubambae* fertility studies.

CONICIBACCATA
S. laxissimum 13706
S. urubambae 13614, 13617, 13740, 13778, 13778A, 13779, 13779A, 13781, 15638, 15650, 15657,
S. urubambae f. *velutinum* 13780, 13783

LIGNICAULIA
S. lignicaule 13584

TUBEROSA
S. bukasovii 11851, 13582
S. coelestispetalum 13683, 13686, 13801, 15666, 15667
S. marinasense 13118, 13740
S. medians-2x 13185
S. phureja 10199, 14972, 15071
S. saxatilis 15082
S. stenotomum 691-85A

19a. *Solanum urubambae* Juz. f. *chakchabambense* Ochoa forma *nov.* (See Latin diagnosis in Spanish edition). Figs. 89-91; Map 10.

Plant and leaves similar to the type species *S. urubambae*, densely pubescent, hairs yellow, short and very fine. Stem cylindrical, stolons up to 2 m or more long, milky-white. Tubers 10 cm or more long and 2.5-4.0 cm in dia., subcylindrical, straight or falcate, the apex obtuse and the base pointed, flesh pure white or occasionally mottled light purple in the area of the phloem. Calyx symmetrical, 7-8 mm long with membranous lobes, narrowly elliptical-lanceolate, the apex attenuate or shortly acuminate. Corolla rotate, 2.5-3.0 cm in dia., pure white or white toward the apical third of the acumen and the internal star pale bluish-gray, acumens short and broad. Anthers yellowish-orange, the apex typically pigmented dark brown. Chromosome Number: 2n=24.

Type: PERU. Department Cusco, Province Urubamba, in the Quebrada Chakchabamba, 2400 m alt., on the right bank of the Chakchabamba River, tributary of the Urubamba River, in *ceja de montaña* and habitat similar to *S. urubambae*, 13 March 1984, *C. Ochoa 15639* (holotype OCH, isotypes CIP, MO, MOL, USM, US).

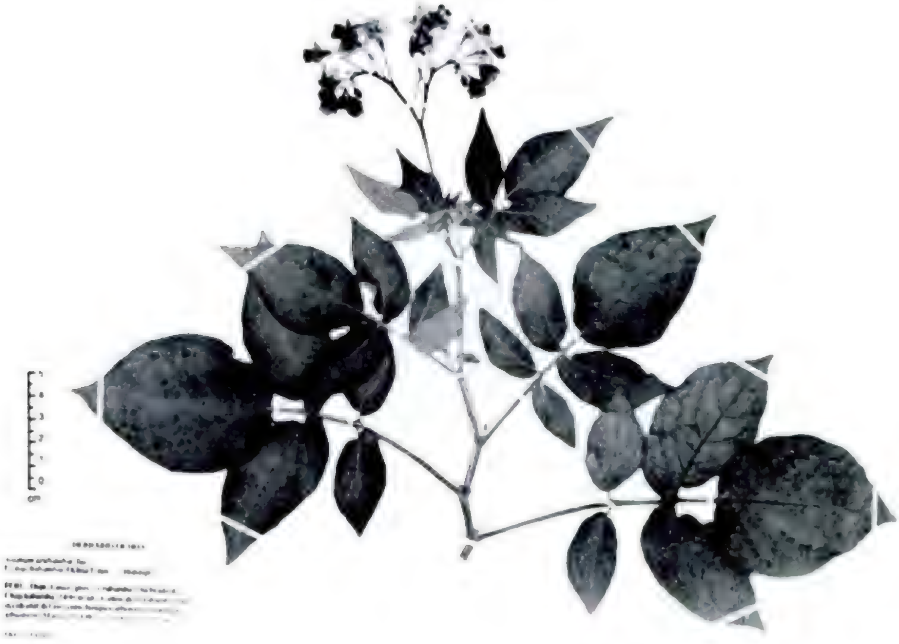


Figure 89. *Solanum urubambae* f. *chakchabambense* (*Ochoa 15639*, holotype).

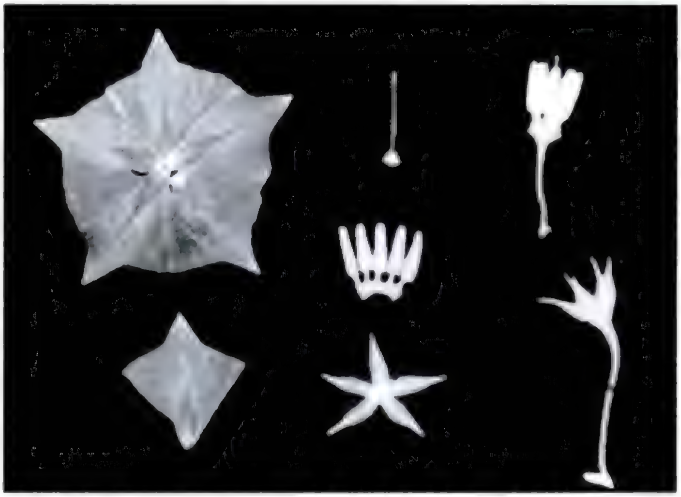


Figure 90. Floral dissection of *Solanum urubambae* f. *chakchabambense* (*Ochoa 15639*, holotype).

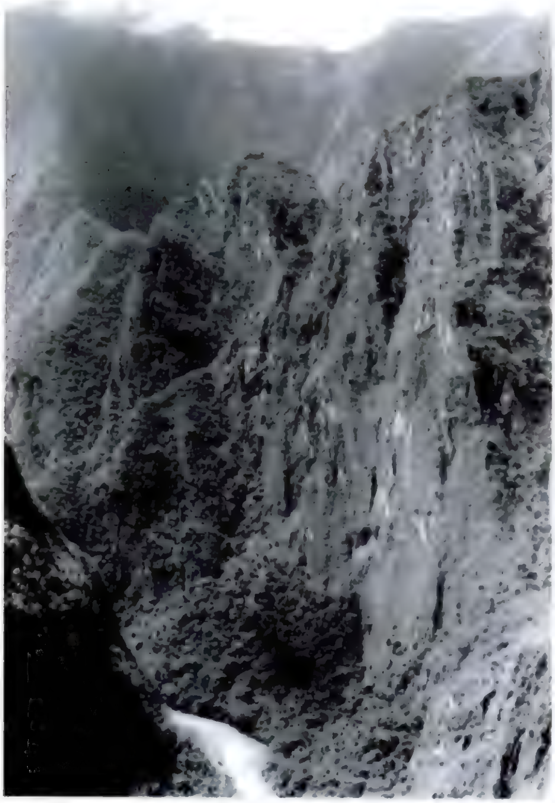


Figure 91. Habitat of *Solanum urubambae* f. *chakchabambense* in the vicinity of Chakchabamba (*Ochoa 15639*).

Specimen Examined

Department Cusco

Province Urubamba: Quebrada de Chakchabamba, 2400 m alt., canyon of the Urubamba, west side of the Chakchabamba River, in tree forests or shrubby thickets, 13 March 1989, *C. Ochoa 15639*, 2n=24 (CIP, MO, MOL, OCH, USM, US).

19b. *Solanum urubambae* Juz. f. *velutinum* (Corr.) Ochoa *comb. nov.*

Basionym: *Solanum santolallae* Vargas f. *velutinum* Corr., Wrightia 2(4):176, 1961.

Figs. 92-94; Map 10.

Plant vigorous, entirely pubescent. Stem tomentose, cylindrical, without wings, flexible. Leaves densely pubescent, essentially velutinous and velvety, with 3-4 pairs of leaflets and 0-1 pairs of interjected leaflets. Leaflets elliptic-lanceolate or narrowly elliptic-lanceolate, the apex acuminate and the base narrowly cuneate to obliquely rounded, subsessile or shortly petiolulate. Corolla rotate-pentagonal or pentagonal, to 3 cm in dia., violet-lilac or dark lilac with a brilliant whitish-gray internal star. Fruit long-conical, to 1.5 cm long.

Type: PERU. Department Cusco, Province Urubamba, along stream, near Machu Pikchu railroad station, flowers purplish, only one plant found (in poor condition), 3 March 1958, *D.S. Correll and E.E. Smith P261* (holotype LL, here designated).

Although the single specimen that represents the type collection of *S. santolallae* f. *velutinum* in the Lundell Herbarium, U.S.A., is sterile, i.e. without flowers (Fig. 92), the sample is sufficient enough to place it positively with *S. urubambae*. It differs largely in the shape of its leaves and in having narrowly lanceolate leaflets. Other specimens that were collected by the author near the type location of this form in the vicinity of the Urubamba River, like those shown in the accompanying illustrations (Figs. 93-94), verify this determination.

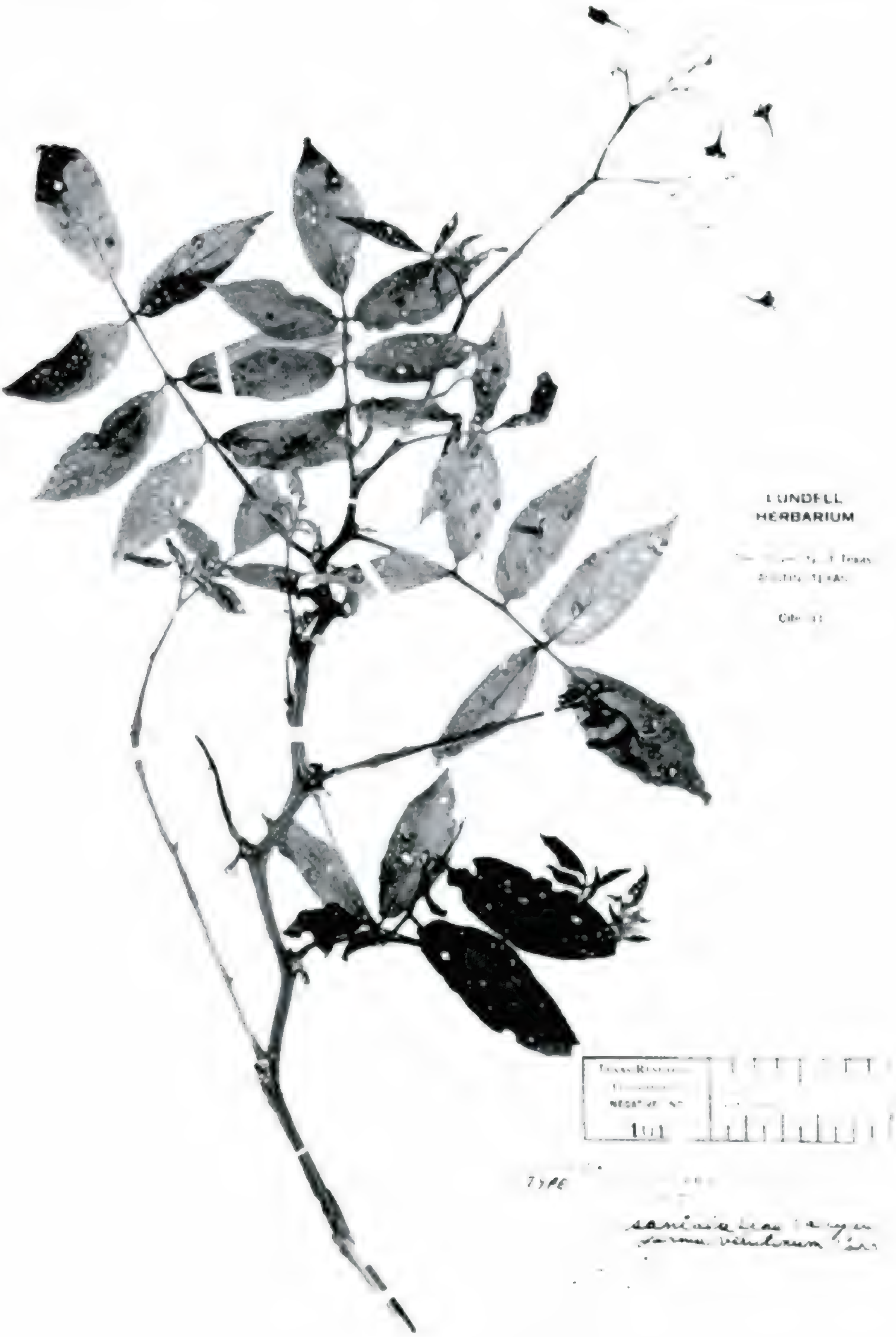


Figure 92. *Solanum urubambae* Juz. var. *velutinum* (Corr.) Ochoa, basionym of *S. santolallae* Vargas f. *velutinum* Corr., *D.S. Correll et E.E. Smith P261.*

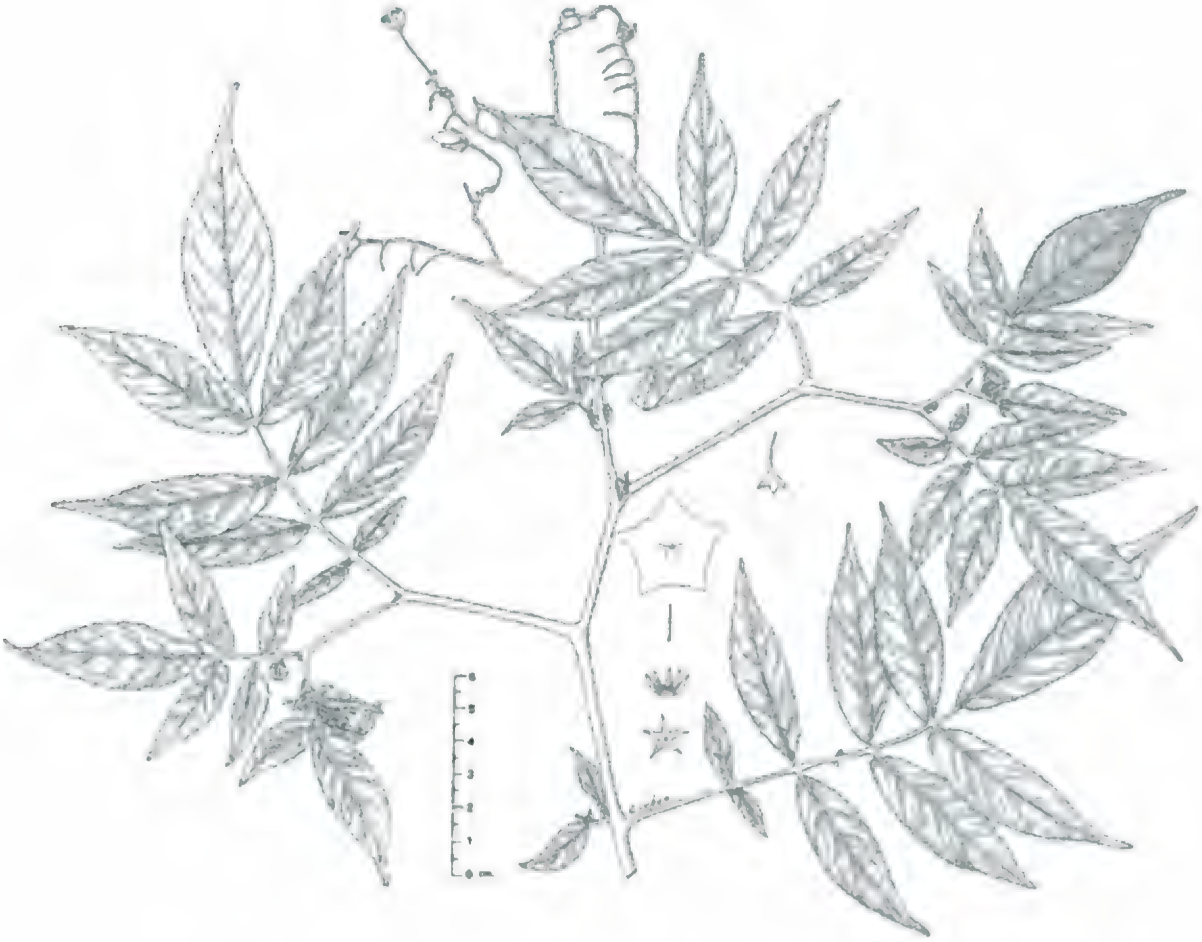


Figure 93. *Solanum urubambae* Juz. f. *velutinum* (*Ochoa 13780*).

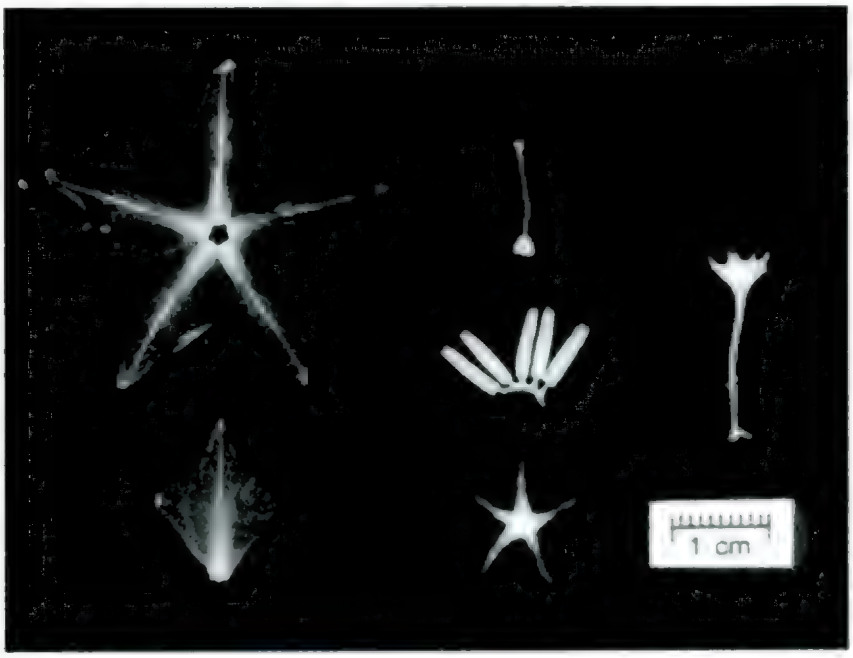


Figure 94. Floral dissection of *Solanum urubambae* f. *velutinum* (*Ochoa 13780*).

Specimens Examined

Department Cusco

Province La Convención: Above Pajchaj, 2900 m alt., flowers very dark purple, leaves with 3-4 pairs of narrowly lanceolate leaflets, very scarce, only one specimen, very poor, February 1980, *C. Ochoa 13615* (OCH). Near Wiñay Pucyo, 2600 m alt., leaves with 3-4 pairs of narrowly elliptic-lanceolate leaflets and very pubescent, flowers dark purple, 15-19 March 1980, *C. Ochoa 13780* (OCH). Lluscamayo Alto, 2580 m alt., near Wiñay Pucyo, March 1980, *C. Ochoa 13783* (OCH).

Province Urubamba: Along stream, near Machu Pikchu railroad station, flowers purplish, only one plant found (in poor condition), 3 March 1958, *D.S. Correll and E.E. Smith P261* (LL, type collection of *S. santolallae* Vargas f. *velutinum* Corr.).

SERIES CUNEOALATA

CUNEOALATA Hawkes, Bull. Imp. Bur. Pl. Breed., Cambridge 118, 1944.

Plants herbaceous, small, bushy and compact or spreading, stoloniferous and tuber-bearing. Leaves imparipinnate; lateral leaflets cuniform at base, winged and decurrent about the rachis. Pedicels articulated near or very near the mid-point. Corolla rotate to substellate or pentagonal, usually with well delimited acumens. Fruits round or ovoid.

Series Megistacroloba is the closest series within this section to series Cuneoalata.

The several species of this series, and especially *Solanum* × *blanco-galdosii*, comprise a valuable potential source of resistant genes for potato improvement purposes, especially against such harmful insects as *Epitrix* sp, *Empoasca* sp., "leaf cutters," and aphids. Resistance to early blight (*Alternaria solani*) and ringrot (*Corynebacterium sepedonicum*) is also encountered in *S.* × *blanco-galdosii*.

Distribution

The various members of this series are widely distributed. Some species occur in Argentina and Bolivia (as in the case of *S. infundibuliforme*) and some in Peru. The three known Peruvian species of this series have been collected so far only from the Departments of Ancash and Cajamarca.

KEY TO SERIES CUNEOALATA

1. Leaves with 4-5(-6) pairs of narrowly lanceolate or linear leaflets and few interjected leaflets.
    2. Corolla substellate .... 20. *S. anamatophilum*
    2. Corolla rotate .... 21. *S. × blanco-galdosii*
1. Leaves with 7-9(-10) pairs of linear leaflets and many interjected leaflets, corolla pentagonal .... 22. *S. peloquinianum*

20. *Solanum anamatophilum* Ochoa, Anal. Cient., Univ. Nac. Agraria, Lima 2(4):391-395, illustr., 1964.

Figs. 95-96; Map 11; Plate IX.

Plant graceful, erect or erect-decumbent, (20-)30-50(-60) cm tall (Fig. 95). Stem usually simple, slender, 2-3(-5) mm in dia. at base, woody or subwoody, somewhat flexed, glabrescent, hairs very short and sparse, internodes (1-)2-4 cm long. Plant stoloniferous and tuber-bearing, stolons short, 15-25 cm long, very slender, less than 1 mm in dia.; tubers moniliform, small, 1.5 cm in dia., round to ovoid, white or white-hyaline. Leaves imparipinnate, (4-)8-12(-15) cm long by (2.0-) 3.5-7.5(-10.0) cm broad, dark green and sparsely pubescent above and lighter green and densely pubescent (including the mesophyll) below, with (3-)5-6 pairs of leaflets and 0-1(-2) pairs of interjected leaflets (Fig. 96); petioles 6-14 mm long. Terminal leaflet narrowly elliptic-lanceolate, slightly larger or approximately the same size as the first pair of lateral leaflets, 3.5-5.0(-6.5) cm long by 1.0-1.2(-1.4) cm broad, the apex obtuse and the base narrowly subfalcate to falcate; the leaflets of the first pair slightly smaller than the second and third pairs, 2.0-4.5(-5.5) cm long by 0.5-1.0(-1.4) cm broad, the apex falcate and the base broadly cuneate and decurrent about the rachis, similar to the remaining leaflets. Pseudostipular leaves narrowly falcate with a pointed apex, 5-7 mm long by 2 mm broad. Inflorescence terminal and lateral, cymose, 4-10-flowered. Peduncle short and slender, to 6 cm long, hairs short and sparse; pedicels 15-20 (-25) mm long, pubescent, articulated 4-5 mm below the calyx. Calyx symmetrical, small, 6 mm long, sparsely pubescent, lobes elliptic-lanceolate with an acuminate apex, acumens 2.5-3.5 mm long, narrowly subspatulate. Corolla substellate, deep purple, 2.5 cm in dia., lobes 10-11 mm long and broad, or sometimes somewhat broader at base, acumens not well delimited, margins pubescent (Fig. 96). Anthers lanceolate 6 mm long, pale yellow; filaments less than 1 mm long, white-hyaline, glabrous. Style 8 mm long, very slender, filiform; exerted 2.5 mm, densely papillose on the lower two-thirds of its length; stigma capitate, very

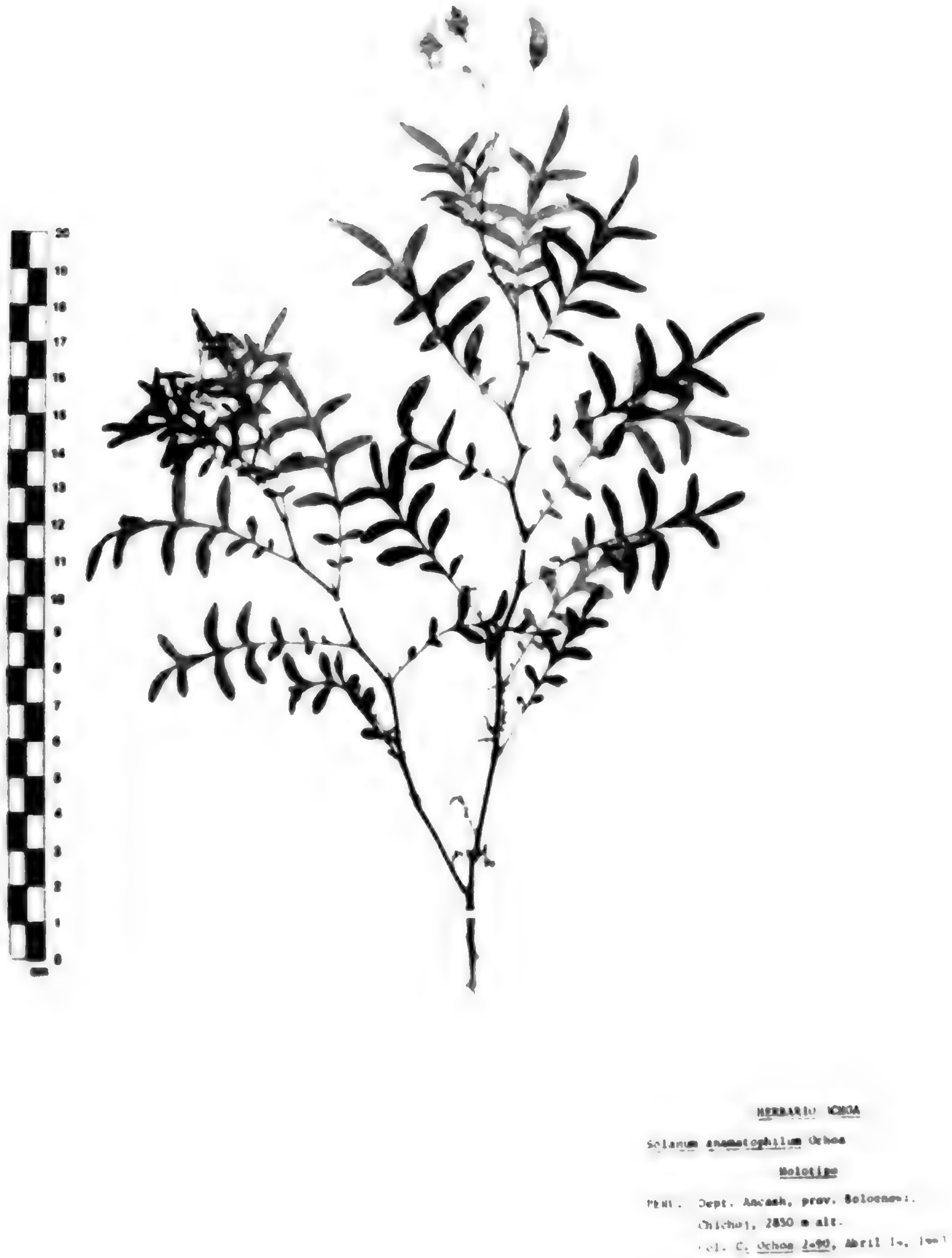

HERBARIO OCHOA
Solanum anamatophilum Ochoa
Holotipo
PERU. Dept. Ancash, prov. Bolognesi:
Chichoj, 2850 m alt.
Col. C. Ochoa 2490, Abril

Figure 95. *Solanum anamatophilum* (*Ochoa 2490*, holotype).

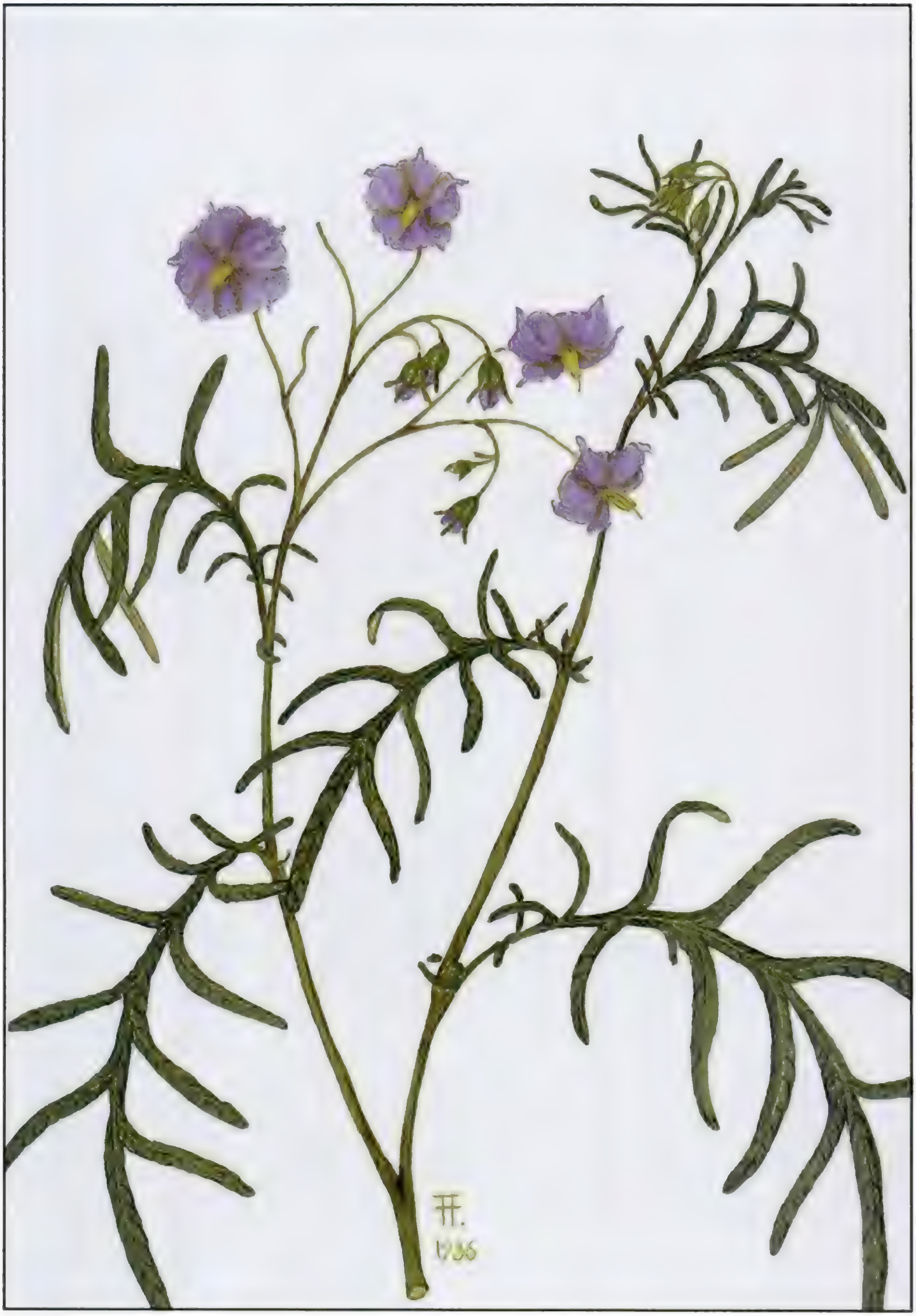


Plate IX. *Solanum anamatophilum* Ochoa.

small, slightly enlarged at style apex. Fruit sub-ellipsoid to ellipsoid, 1.5 cm long, greenish-yellow, streaked with light violet or dark brown (Fig. 96). Chromosome Number: 2n=24. EBN=1.

Local name: *Papa de Zorro*

Type: PERU. Department Ancash, Province Bolognesi, Chichoj, 2700 m alt., among subxerophytic mountain shrubs, 14 April 1963, *C. Ochoa 2490* (holotype OCH, isotypes LE, MO).

Affinities

Solanum anamatophilum shows some relationship to *S. peloquinianum* by its similar habit and in having a slightly woody stem, pedicels that are articulated near the calyx, and cuneiform, decurrent leaflets. However, the two differ radically in corolla shape and leaf dissection, as well as in the size and shape of their leaflets. This species also shows some relationship to *S. infundibuliforme*, a widely distributed Argentine-Bolivian species having similarly-formed leaves and leaflets.

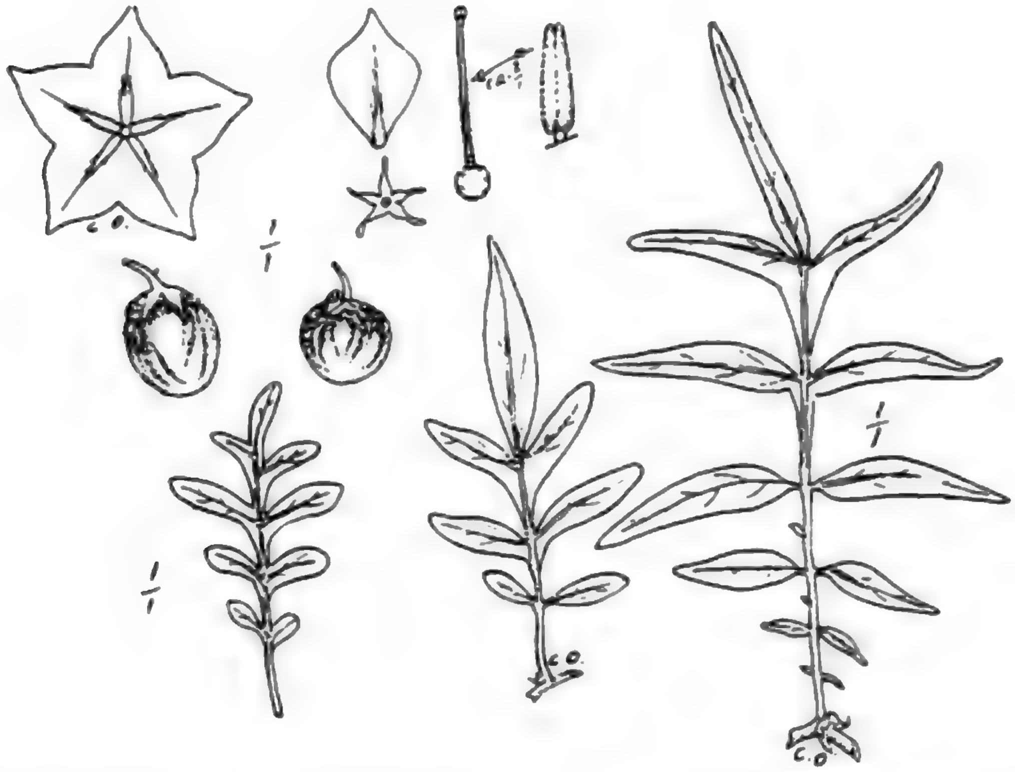
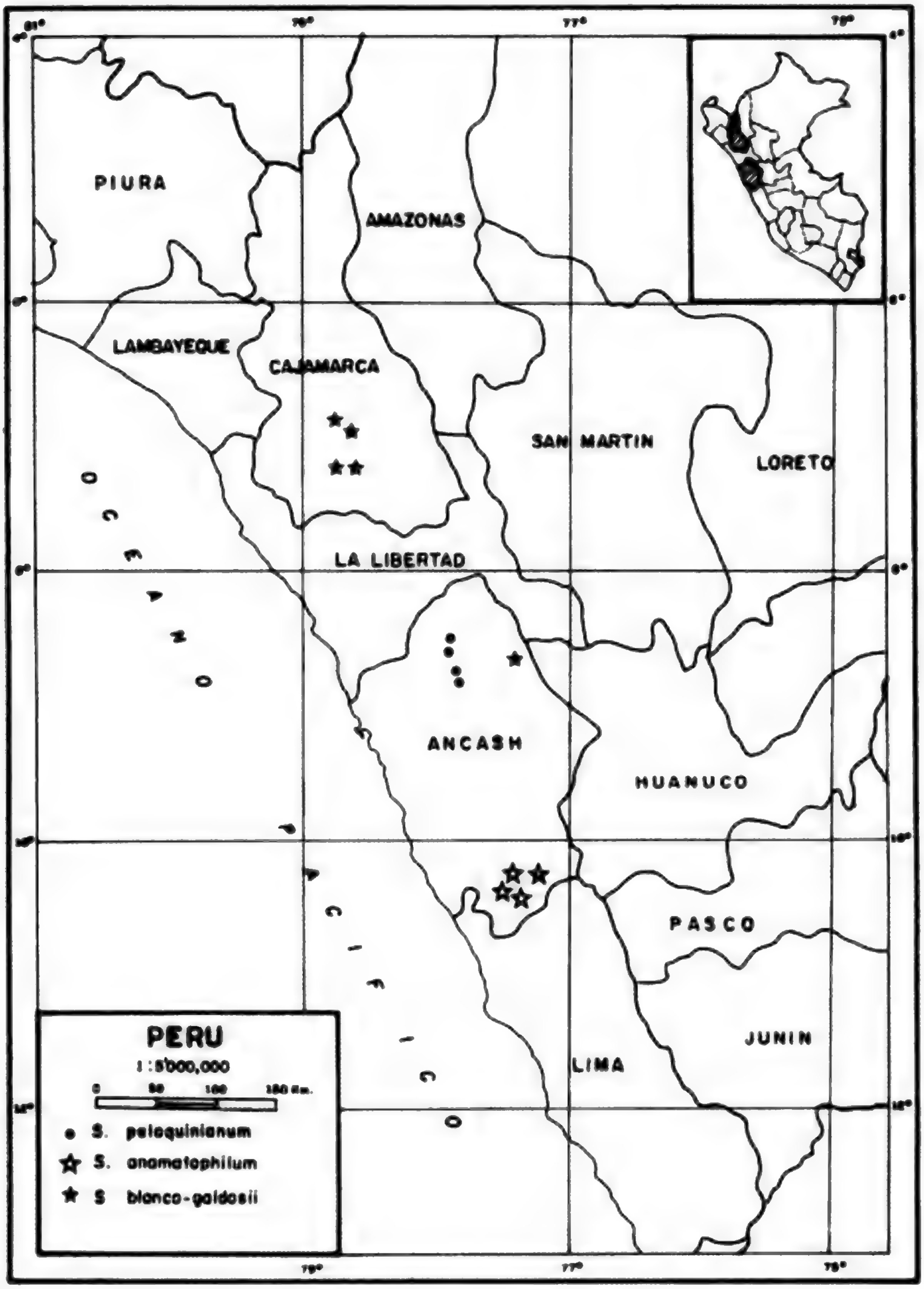


Figure 96. Details and berry and leaf shape of *Solanum anamatophilum* (*Ochoa 2490*).



Map 11. Distribution of *S. anamatophilum, S. blanco-galdosii* and *S. peloquinianum*.

Habitat and Distribution

As signified by the meaning of its specific name, which is compounded from two Greek and Latin words, *S. anamatophilum* prefers dry or only slightly moist habitats. It grows in the shade of *Schinus molle* and *Caesalpina spinosa* trees in xerophytic or subxerophytic quebradas associated with prickly pear (*Opuntia* sp.) and columnar cacti (*Trichocereus* sp.) and shrubs such as *Dodonea viscosa* and *Cassia* sp.

This species is apparently endemic to the Purish and Chichoj Quebradas, these forming a system of dry valleys extending to Timpo and Mascash in the Province of Bolognesi, Department of Ancash. It is known presently only from elevations between 2750 and 2820 m (Map 11).

Specimens Examined

Department Ancash

Province Bolognesi: Purish (Chiquián Valley), road to Pancal, 2800 m alt., on low subxerophytic mountain, flowers purple, 15 April 1961, *E. Cerrate 3738* (OCH, USM). Between Chiquián and Pancal, 2750 m alt., heading down the Purish Quebrada , 2 March 1962, *C. Ochoa 2399* (CIP, GH, MO, MOL, OCH, US). Near Purish, 2800 m alt., heading down the quebrada toward Pancal, in poor subxerophytic vegetation, 14 April 1963, *C. Ochoa 2489* (MO, OCH). Chichoj, 2820 m alt., between Timpo and Mascash, 14 April 1963, *C. Ochoa 2490* (LE, MO, OCH, type collection of *S. anamatophilum*).

21. *Solanum* × *blanco-galdosii* Ochoa (= *S. chomatophilum* Bitt. × *S. peloquinianum* Ochoa). Figs. 97-101; Map 11.

The Series Cuneolata in the north of Peru, *S. blanco-galdosii* Ochoa, Anal. Cient., Univ. Nac. Agr., Lima 11(3-4):157-160, illustr., 1973.

Plant graceful, glabrous, erect or laxly erect, (10-)25-35(-50) cm tall. Stem cylindrical, wingless, light green, simple or rarely branched, somewhat flexed, slender, 2-4 mm in dia. at base, internodes 1-2(-4) cm long. Plant stoloniferous and tuber-bearing, stolons 1.50 m long, thick and fleshy, 1.5-3.0 mm in dia., white. Tubers round or elongated, white, small, 1.5-3.0 cm long, occasionally moniliform or submoniliform. Leaves imparipinnatifid to imparibipinnatifid, very rarely simply imparipinnate, with 4-5(-6) pairs of leaflets and several interjected leaflets, decurrent finally on the narrow rachis and unequally winged (Fig. 100); petiole very short 5-10 mm long. Leaves (2.5-)7.0-9.0 cm long by (1.5-)5.0-7.0

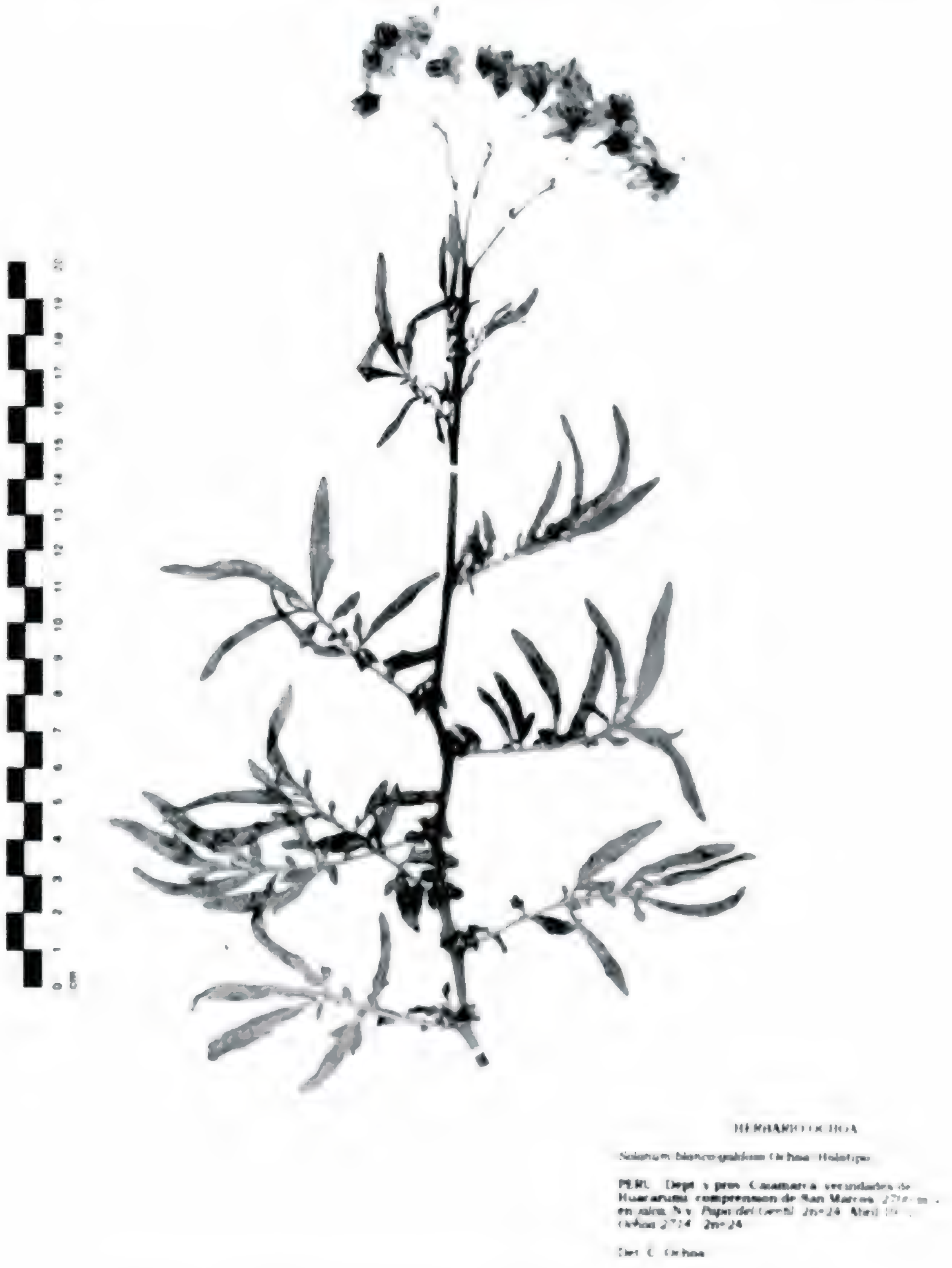


Figure 97. *Solanum* × *blanco-galdosii* (*Ochoa 2714*, holotype).

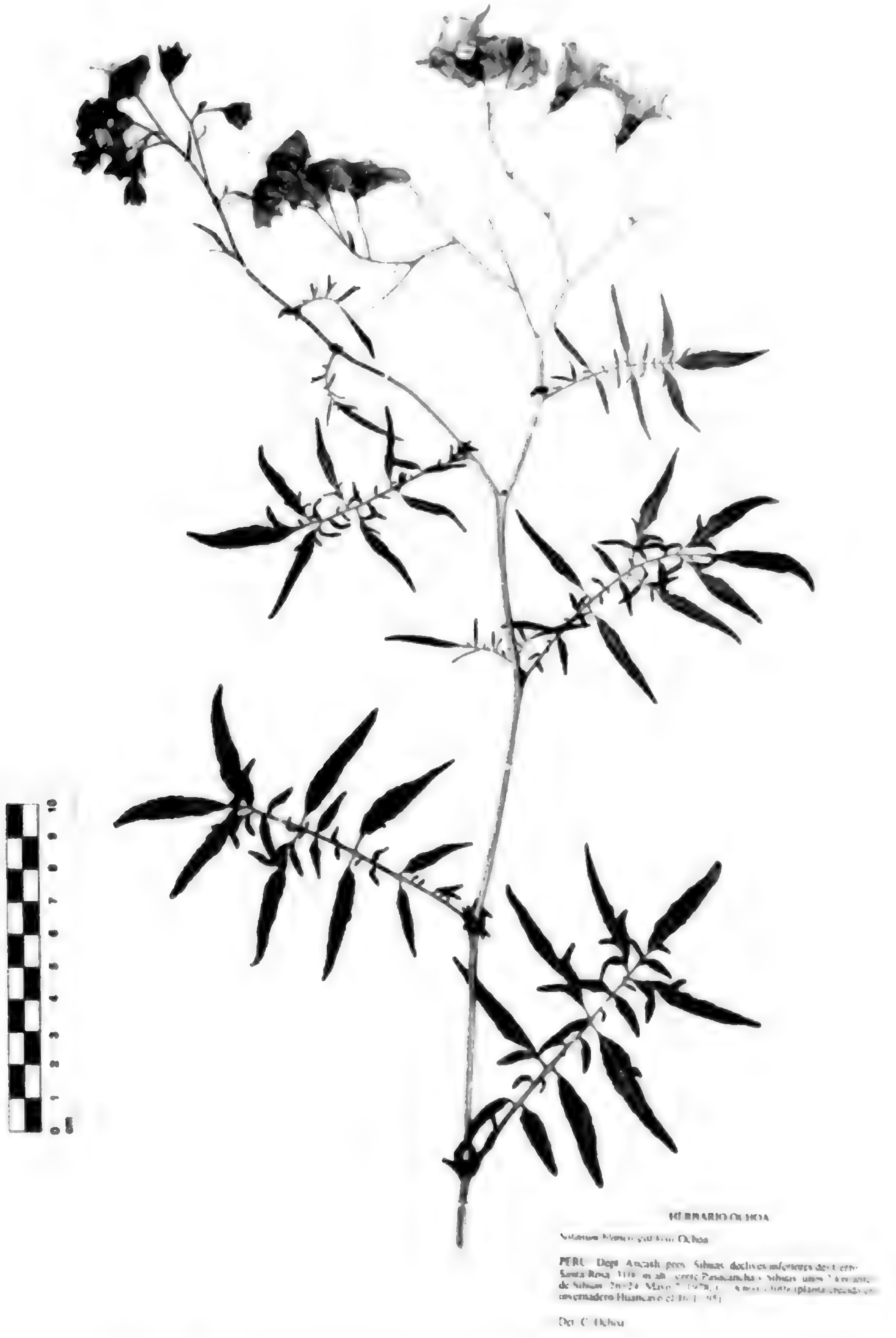


Figure 98. *Solanum* × *blanco-galdosii* (*Ochoa 13009*).

cm broad; leaflets very narrowly lanceolate, the apex generally obtuse, somewhat coriaceous, subvernicose and glabrous above; opaque, light green and slightly pilose on the veins below; terminal leaflet of the same size or slightly larger than the leaflets, (1.7-)3.5-4.5 cm long by 0.2-0.7 cm broad; the first pair of lateral leaflets conspicuously decurrent about the rachis, the remaining leaflets more narrowly and unequally decurrent about the rachis or occasionally subsessile. Pseudostipular leaves broadly falcate, (4-)7-10 mm long by (1.5-)5-6 mm broad. Inflorescence generally cymose, 8-15-flowered. Peduncle glabrous like the pedicels and calyx, short, 2-4 cm long, slender, 1.5-2.0 mm in dia. at base; pedicels very dark purple, 10-20(-30) mm long, slender, less than 1 mm in dia., articulated 4-5 mm below the calyx. Calyx symmetrical or asymmetrical, glabrous, 7 mm long, lobes narrowly elliptic-lanceolate, acumens pointed, 1.5 mm long. Corolla rotate, small, 2.5 cm in dia., deep purple, with a more brilliant internal star (Fig. 99). Anthers narrowly lanceolate, 5 mm long, pale yellow; filaments very short, less than 1 mm long, white-hyaline, glabrous. Style short, 8 mm long, exerted 2.5 mm, slightly papillose on the lower third of its length; stigma ovoid, small, dark green. Fruit round to ovoid, to 2 cm long, green-glaucous, marked with deep violet vertical streaks and very small white dots, not verrucose (Fig. 99). Chromosome Number: 2n=24. EBN=2.

Local name: *Papa del Gentil*

Type: PERU. Department and Province of Cajamarca, vicinity of Huacarumi, "comprensión de San Marcos," 2700 m alt., April 1971, C. *Ochoa 2714* (holotype OCH, isotypes MOL, OCH, USM, US).

When the original diagnosis of this highly PLRV resistant (i.e. viral leafroll) plant was made, it was not suspected to be of hybrid origin. Later, during

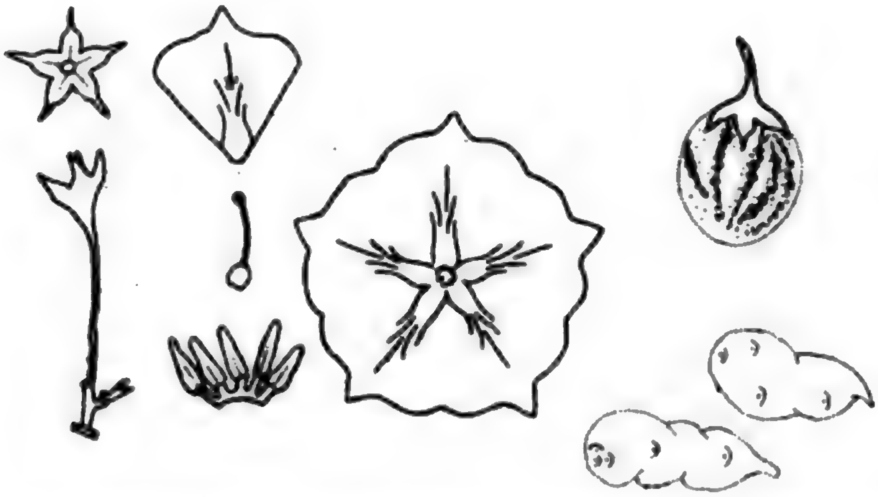


Figure 99. Floral parts, berry and tubers of *Solanum* × *blanco-galdosii* (*Ochoa 2714*, holotype).

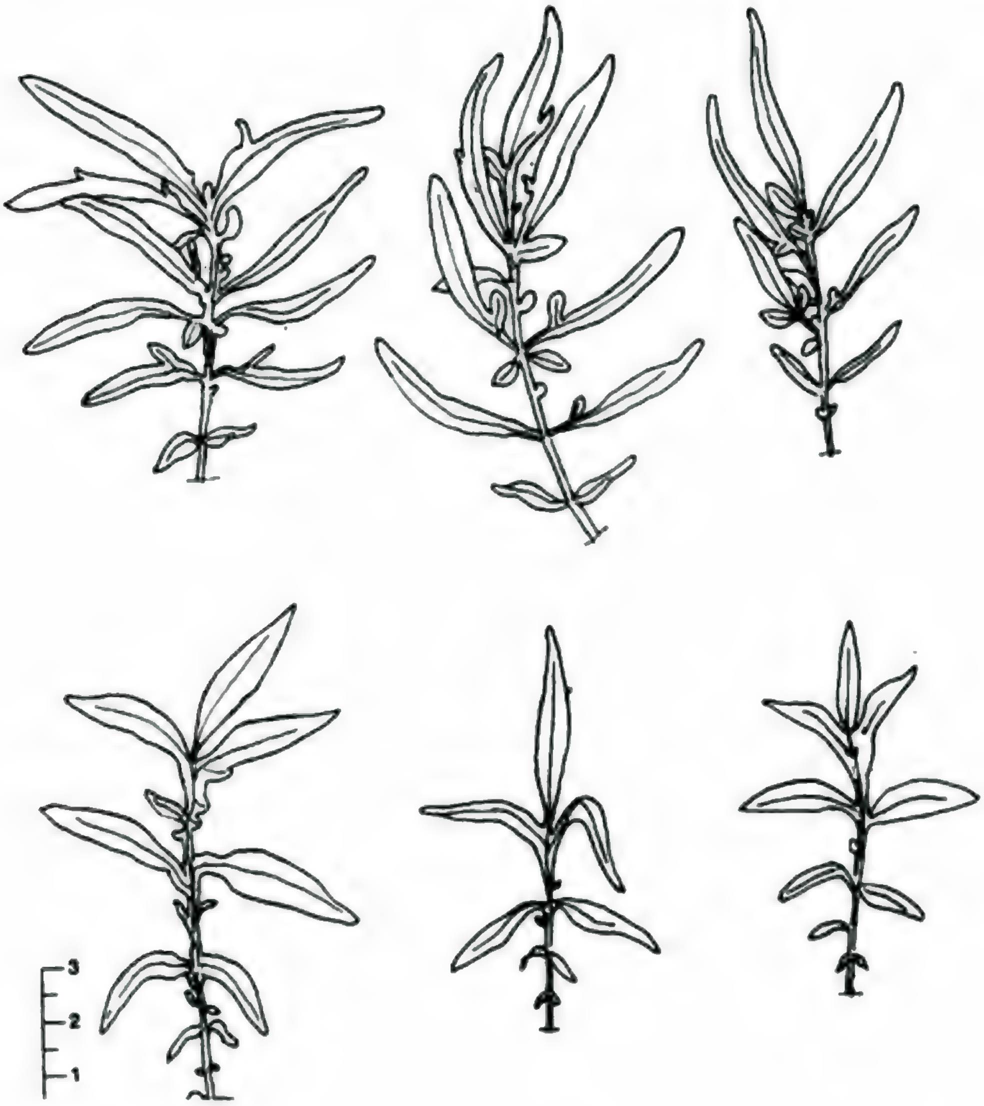


Figure 100. Leaves of *Solanum × blanco-galdosii* (*Ochoa 2714,* holotype).

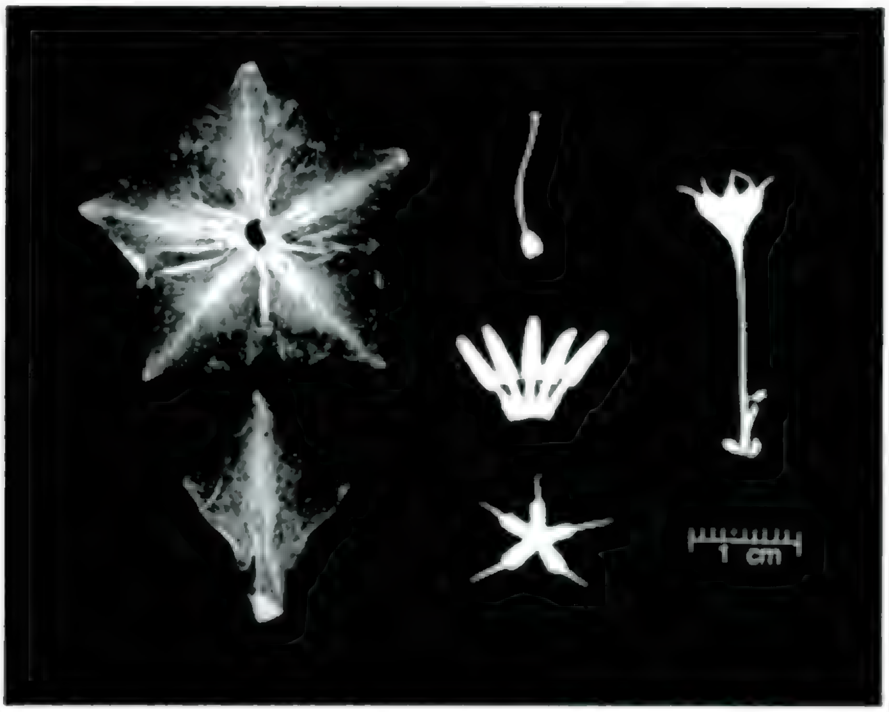


Figure 101. Floral dissection of *Solanum × blanco-galdosii* (*Ochoa 13009*).

multiple-crossing investigations at CIP, this plant was synthetically obtained in crosses of *S. chomatophilum* (series Conicibaccata) with *S. peloquinianum* (series Cuneoalata), but only when the latter was used as the staminate parent. Thus, its present taxonomic treatment reflects its status as a vegetatively-reproducing hybrid form rather than as a species. Because of its conspicuously decurrent leaves, it is treated here under the series Cuneoalata rather than under Conicibaccata.

Affinities

Related obviously to *S. peloquinianum* and *S. anamatophilum* by virtue of its hybrid origin.

Habitat and Distribution

This hybrid occurs at medium altitudes (2700-3100 m) in cool places or jalcas, principally in the Province and Department of Cajamarca in northern Peru. However, it also occurs very locally in the Province of Sihuas, Department of Ancash (Map 11).

Specimens Examined

Department Ancash

Province Sihuas: Lower foothills of Cerro Santa Rosa, in *jalca*, to 3100 m alt., 2 km before Sihuas, heading down from Pasacancha, tubers 1-2 cm in dia., 7 May 1978, *C. Ochoa 13009* (CIP, F, OCH, US).

Department Cajamarca

Province Cajamarca: *Jalcas* of Huacarumi, April 1964, *C. Ochoa S-68* (represented by No. *PI-365368* at Sturgeon Bay, Wis., USA). Vicinity of Huacarumi, "comprehension de San Marcos", ca. 2700 m alt., in *jalca*, n.v.: *Papa del Gentil*, April 1971, *C. Ochoa 2714*, 2n=24 (holotype OCH, isotypes MOL, OCH, USM, US). In *jalcas* along the Cajamarca-San Marcos road, 2750-2850 m alt., February 1972, *C. Ochoa 3252* (CIP, MOL, OCH, UNTC, USM, US). *Jalcas* of Laisón, 2900 m alt., on the Cajamarca-Cumbemayo road, scarce, flowers violet, March 1987, *C. Ochoa and A. Salas 15998* (CIP, OCH).

In examining the living collections at Sturgeon Bay, Wis., I discovered two plant introduction numbers that were determined as *S. blanco-galdosii: PI-442702* (= *OCH-5169*) and *PI-442701* (= *OCH-10673*). However, these two numbers, originally collected by me, actually correspond to the wild species *S. limbaniense* from the Prov. Sandia, Puno, Peru, and a native cultivar, *S.* × *chaucha*, from the Bolivian altiplano.

22. *Solanum peloquinianum* Ochoa, Am. Potato J. 57:33-35, 1980.

Figs. 102-107; Map 11.

Plants graceful, erect to erect-decumbent, 40-50 cm tall. Stem simple or branched, woody or slightly woody, cylindrical, wingless, slender, 3-5 mm in dia.at base, glabrous, densely flecked with either light or dark pigments in the basal one-third of its length. Plant stoloniferous and tuber-bearing, stolons 45 to 80 cm or more long. Tubers white or whitish-yellow, round to ovoid, long subcylindrical or long pyriform, small, 3-4 cm long (Fig. 105). Leaves thick, 9-12(-20) cm long by 4.5-9.0(-14.0) cm broad, dark green and glabrous above, light green and sparsely pubescent below, pinnatisect or very rarely bipinnatisect, very divided, with 7-9 (-10) pairs of lateral leaflets and (0-)2-3(-4) pairs of interjected leaflets. Leaflets very narrowly lanceolate to linear-lanceolate; the first and second pairs slightly falcate, apex obtuse, base broadly cuneate and decurrent about the rachis, the decurrency diminishing gradually between each pair of leaflets. Terminal leaflet more or less of the same size as the first pair of leaflets but smaller than the second and third pairs, (3.0-)4.5-5.5 cm long by 0.2-0.3 cm broad; the middle leaflets 6.5-7.0 cm long by 0.4 cm broad. Pseudostipular leaves when present, generally very small, straight or narrowly subfalcate, with pointed apex. Inflorescence terminal, usually cymose, 6-10-flowered. Peduncle slender, glabrous, 6-12 cm long; pedicels 20-30(-40) mm long, articulated 4-5 mm below base of calyx, very sparsely pubescent like the calyx. Calyx asymmetrical, light green, 5.5-6.0 mm long, lobes elliptic-lanceolate with acuminate apex, the acumens pointed or very narrowly subspatulate, to 2.5 mm long. Corolla rotate, small, 2.0-2.5 cm in dia., purple with a dark lilac internal star, acumens not well delimited from the lobes (Fig. 103). Anthers 6 mm long, broadly lanceolate with a well defined dorsal groove and cordate base; filaments very short, less than 1 mm long, pubescent, purplish near base of anthers, with a dense inter-filamental pubescence. Style 8-9 mm long, exerted 2.5 mm, sparsely papillose on the lower two-thirds of its length; stigma shortly claviform, cleft. Fruit round or slightly ovoid, small, 1.0-1.5 cm in dia., green diffused with lighter green at apex or green with 1 or 2 vertical violet streaks (Fig. 104). Chromosome Number: 2n=24. EBN=2.

Local name: *Papa de Pájaro*

Type: PERU. Department Ancash, Province Corongo, District La Pampa, on the steep gravely talus slopes of Cerro Chuirajra, 1720 m alt., along the Yuracmarca-Sihuas road, March 1979, *C. Ochoa 13222* (holotype OCH, isotypes CIP, LE, MO, MOL, NY, US).

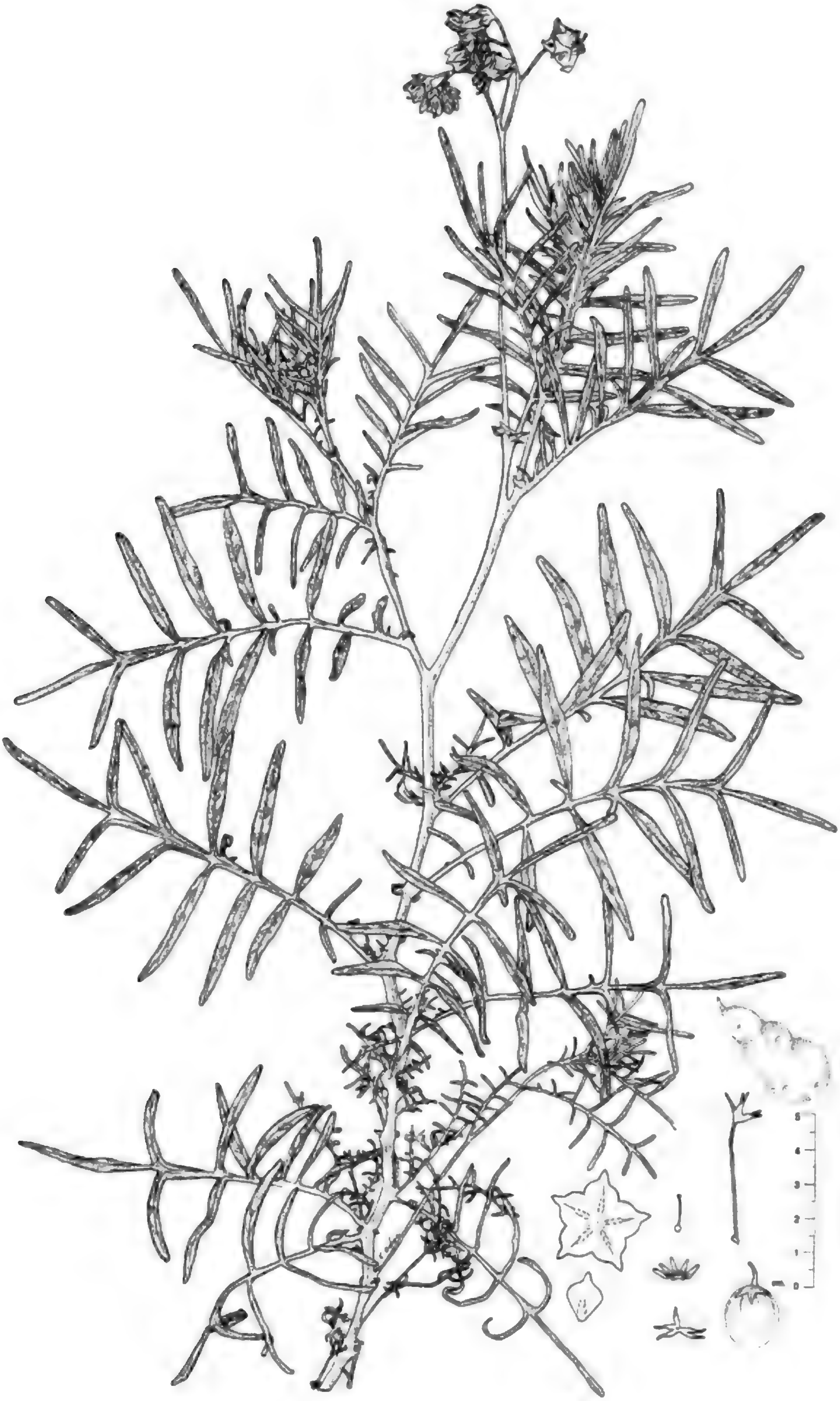


Figure 102. *Solanum peloquinianum* (*Ochoa 13222*, holotype).

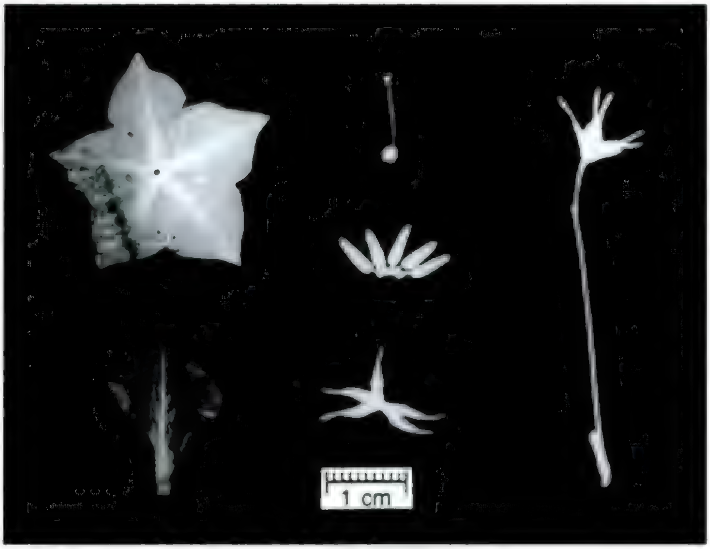


Figure 103. Floral dissection of *Solanum peloquinianum* (*Ochoa 13002*).

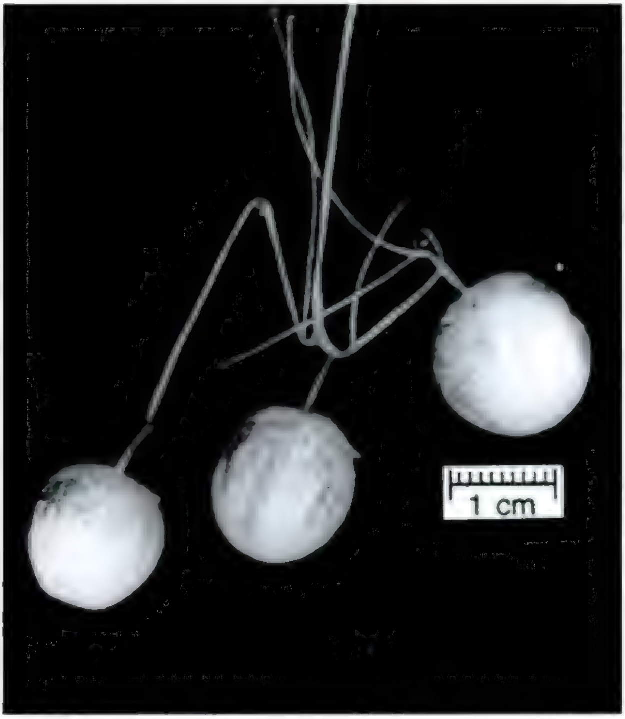


Figure 104. Berries of *Solanum peloquinianum* (*Ochoa 13231*).

Since this species is capable of thriving in fairly arid habitats similar to those of *S. anamatophilum*, it may be valuable as a source of genes for the improvement of the common potato. Certainly, given the morphology and texture of the leaves in *S. peloquinianum*, including their possibly high glyco-alkaloid content, it is possible that this species may be resistant to the attacks of certain insects such as *Epitrix* or *Empoasca*.

Affinities

Save for the strong segmentation of its leaves and its uniquely different leaflets and calyx, *S. peloquinianum* would appear to be closely related to *S. anamatophilum*. However, both species show much variability with respect to leaf shape and the number of pairs of leaflets and interjected leaflets, as occurs similarly in *S. infundibuliforme*, another closely related species that could be split, conceivably, into a number of smaller ones. However, there is always the danger that further splitting would result only in the proliferation of synonyms. Further field and laboratory work is indicated here.

Habitat and Distribution

Solanum peloquinianum is an inhabitant of xerophytic habitats. As in the case of the related *S. anamatophilum*, this species grows in either poor sandy-clay soils or in stony or rocky soils on steep talus slopes where it may be associated with

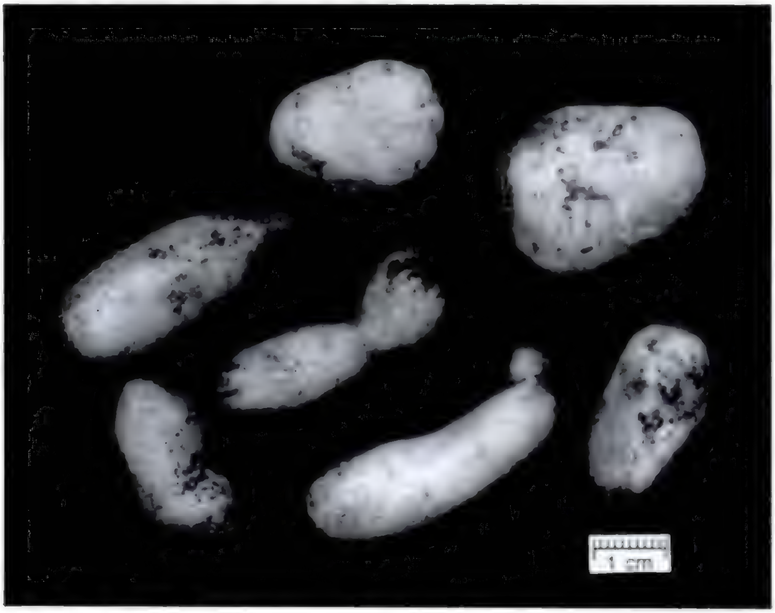


Figure 105. Tubers of *Solanum peloquinianum* (*Ochoa 13002*).

bromeliads, euphorbias, cacti and such shrubby genera as *Agave* and *Furcraea*, as well as herbs of the genus *Commelina*, *Amaranthus*, *Salvia* and *Oxalis*. Geographically, the distribution of this species is restricted to the Provinces of Corongo and Huaylas in the Department of Ancash in northern Peru, where it grows at altitudes between 1720 and 2300 m (Figs. 106, 107, Map 11).

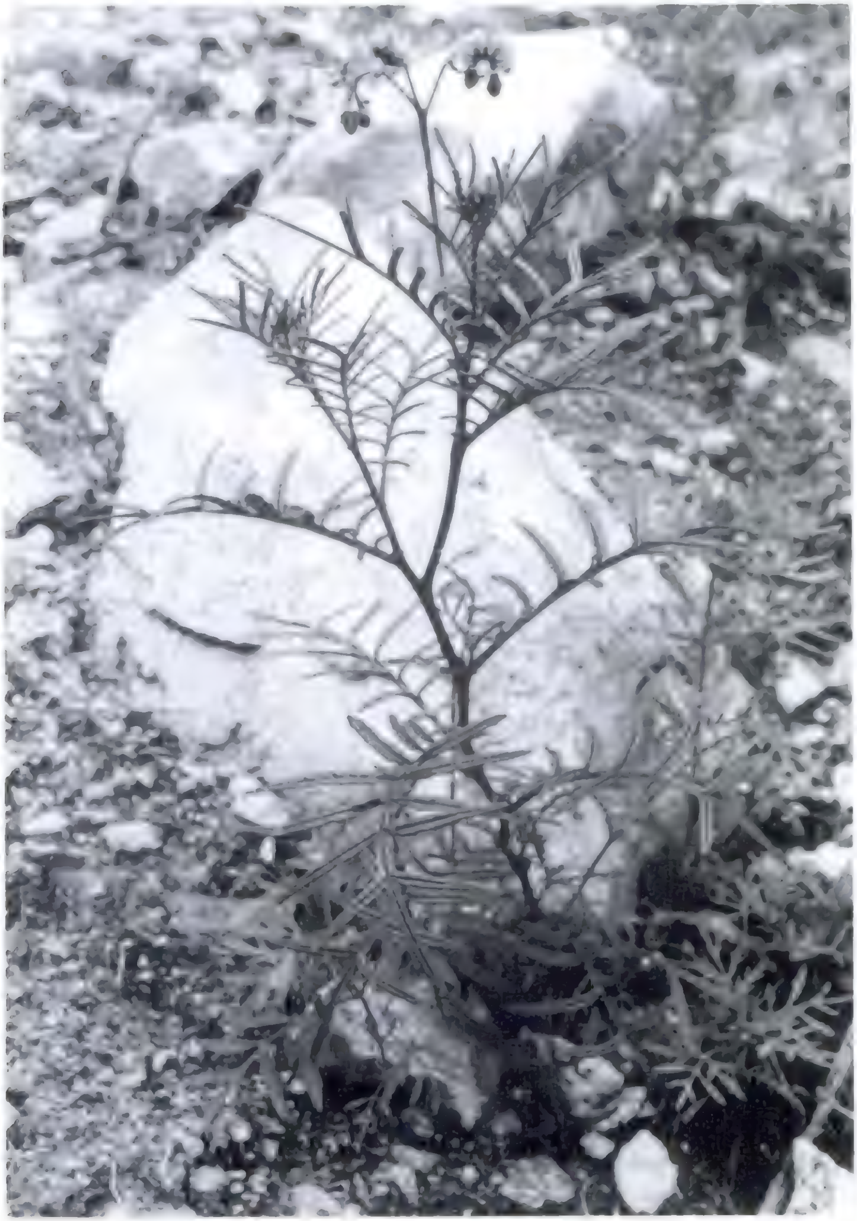


Figure 106. Habitat of *Solanum peloquinianum* in its type locality (*Ochoa 13222*, holotype).

Specimens Examined

Department Ancash

Province Corongo: District La Pampa, Peña Patacta, 2000 m alt., past Puente Grande, on the road to Corongo, berries round, tubers very small (1 cm) and moniliform, 3 May 1978, *C. Ochoa 13002*, 2n=24 (CIP, GH, MO, MOL, OCH, US). District La Pampa, Chuirajra, 1720 m alt., on very steep stony talus slopes to the east of the Munta River, plants with slender slightly woody stems, associated with xerophytes such as euphorbias, bromeliads and cacti, shrubs such as *Agave* and *Fourcroya*, and herbs such as *Commelina*, *Salvia* and *Amaranthus*, 20 March 1979, *C. Ochoa 13222*, 2n=24 (CIP, LE, MO, MOL, NY, OCH, US, type collection of *S. peloquinianum*). Stony foothills of the mountains between Tres Cruces and Huiñac, 2100 m alt., about 10 km above Santa Rosa, plants very young, without flowers, 20 March 1979, *C. Ochoa 13223* (CIP, OCH).

Province Huaylas: Lliquipajcha, 2300 m alt., on the Huaylas-Huallanca road, in gravely soils, arid subxerophytic habitat, associated with some cacti, 21 March 1979, *C. Ochoa 13230*, 2n=24 (CIP, MO, OCH, US). Between Huaylas and Huallanca, 2250 m alt., abundant colonies of still very young plants growing on slate-shale talus slopes, 21 March 1979, *C. Ochoa 13231*, 2n=24 (OCH).

Table 21. Fertility of *Solanum peloquinianum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	TUBEROSA	× *S. mochiquense*	6(3)	4(3)	39(12)
24	2	CONICIBACCATA	× *S. chomatophilum*	23(90)	15(54)	19(40)
24	2	CUNEOALATA	× *S.* × *blanco-galdosii*	12	11	52
24	2	PIURANA	× *S. ariduphilum*	13	11	90
24	2	TUBEROSA	× *S. goniocalyx*	3(5)	0(4)	0(0)
			× *S. phureja*	7	2	0

FL= total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

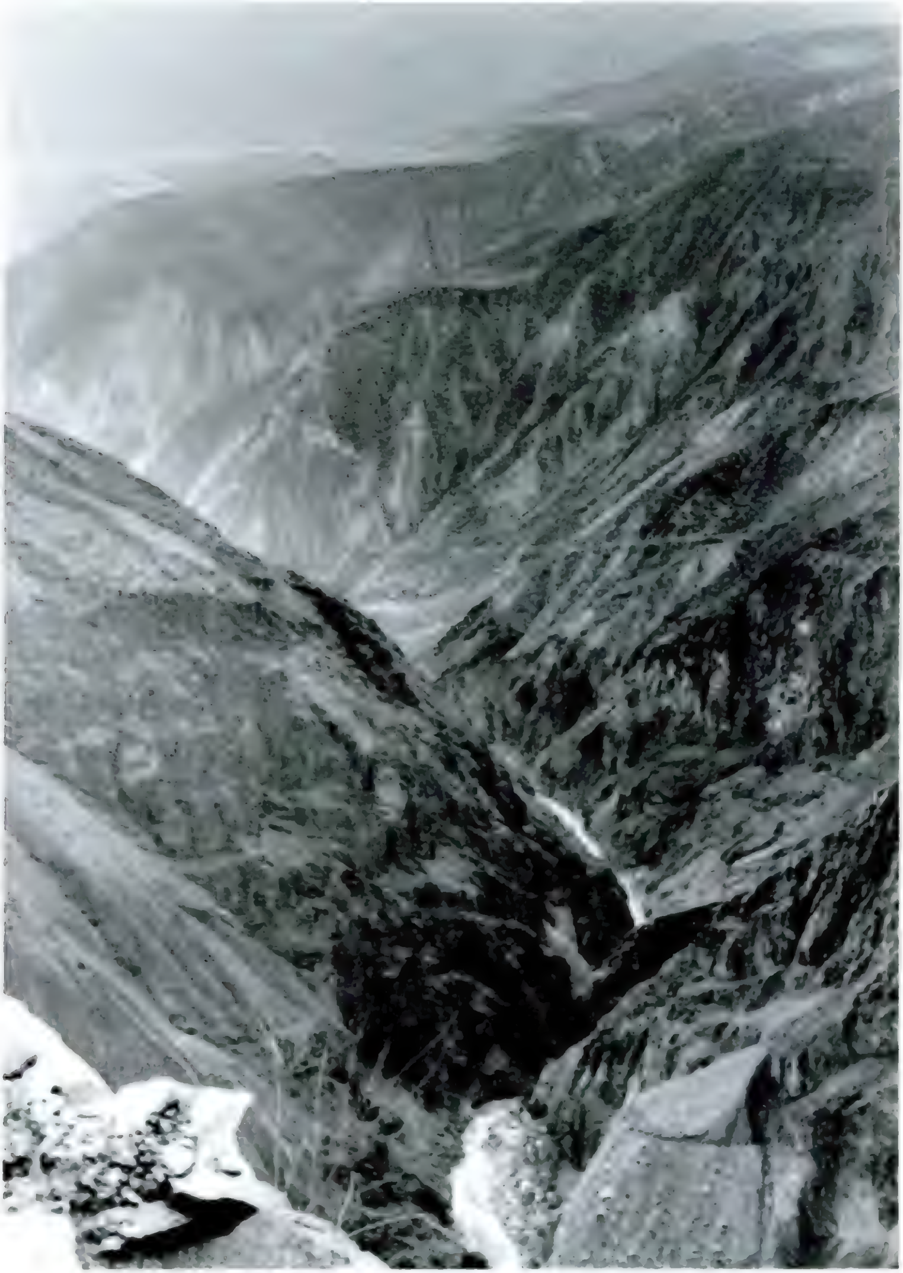


Figure 107. View from Chuirajra of the Cañón del Munta, habitat and type locality of *Solanum peloquinianum*.

Breeding Potential

The results of crosses of *S. peloquinianum* with diploid species (2n=24) of EBN=1 and EBN=2 are given in Table 21; whereas the materials used in these experiments are shown in Table 22.

Some compatibility was found in reciprocal crosses of *S. peloquinianum* (series Cuneoalata) with *S. mochiquense* (series Tuberosa), both EBN=1, even though these two species belong to rather distantly related series. However, reciprocal crosses with *S. goniocalyx*, also of series Tuberosa but EBN=2, were not successful.

Another surprising result came from our experimental crossing program involving *S. peloquinianum* and *S. chomatophilum* of series Conicibaccata. Here, even though the two species have different EBN values and belong to entirely different series, some compatiblity was observed in reciprocal crosses. Similar results were obtained in crosses involving *S.* × *blanco-galdosii* of series Cuneoalata and *S. ariduphilum* of series Piurana, but only in cases where *S. peloquinianum* was used as the female parent.

Table 22. Collections (OCH) used in *Solanum peloquinianum* fertility studies.

CONICIBACCATA
S. chomatophilum 13010, 13198, 13199, 13200, 13206, 13208, 13325, 13840, 13844, 14484, 14485, 14786.

CUNEOALATA
S. × *blanco-galdosii* 13009.
S. peloquinianum 13002, 13230, 13231

PIURANA
S. ariduphilum 2637.

TUBEROSA
S. goniocalyx 00001.
S. mochiquense 14820.
S. phureja 15137.

SERIES INGAEFOLIA

INGAEFOLIA Ochoa, *Solanum Tuberiferos Silvestres del Perú*, Lima, 68, 1962; ex Correll, Texas Res. Found. Contr. 4, 129, 1962.

Plants robust, subshrubby, erect-ascending or herbaceous and decumbent, stoloniferous and tuber-bearing. Leaves imparipinnate, with a broadly winged rachis. Pedicels articulated usually near the base of the calyx. Corolla rotate. Ovary and mature fruits orbicular to ovoid.

Series Ingaefolia is closely related to series Olmosiana. Plants of both series characteristically have a broadly winged leaf rachis, but differ greatly withrespect to corolla shape. Chromosome Number: 2n=24. EBN=2.

Distribution

The Andes of the departments of Cajamarca, La Libertad and Piura in northern Peru.

KEY TO SERIES INGAEFOLIA

1. Plants to 2 m tall, internode length 8-15 cm; Tubers large, greater than 10 cm long.
    2. Stem broadly winged; Leaves with (1-)2-3(-4) pairs of leaflets, without interjected leaflets; Corolla blue; Calyx asymmetrical .... 23. *S. ingaefolium*
    2. Stem narrowly winged; Leaves with 4-5(-6) pairs of leaflets and (0-)1- ... 3(4) pairs of interjected leaflets; Corolla white; Calyx symmetrical .... 25. *S. raquialatum*

1. Plants to 0.60 cm tall, internode length 0.5-3.0 cm; Tubers small, less than 4 cm long.
    3. Plant glabrous; Leaves with (2-)3-4 pairs of leaflets and few interjected leaflets .... 24. *S. jalcae*
    3. Plant pubescent; Leaves with 4-5 pairs of leaflets and many interjected leaflets .... 24a. *S. jalcae* var. *pubescens*

23. *Solanum ingaefolium** Ochoa, Agronomía, Lima, 26(4):319-322, illustr., 1959. Figs.108-110 ; Map 12.

Plant robust, erect to erect-ascending, slightly woody, to more than 2 m tall, usually smaller, very sparsely pilose. Stem thick, 15 mm or more in dia. at base, broadly straight or sinuously winged, branched, pigmented or slightly so, internodes long, to 8-15 cm. Plant stoloniferous and tuber-bearing, stolons 50 cm or more long; tubers large, 20 cm long by 4 cm thick, long, straight or subfalcate to falcate, cylindrical or subcylindrical, white, with numerous lenticels (Fig. 110). Leaves imparipinnate, dark green and very sparsely pilose above, lighter green and less pilose below, long, (17-)25-40 cm in length by (10.0-)17.5-30.0 cm broad, with (1-)2-3(-4) pairs of leaflets, without interjected leaflets, raquis broadly winged, petioles ranging from short (0.8 cm) to long (5 cm) or very long (9 cm); leaflets narrowly elliptic-lanceolate to elliptic-lanceolate, the apex long acuminate and the base cuneate, sessile and broadly decurrent about the rachis; terminal leaflet occasionally somewhat rhombic-lanceolate, of the same size or slightly larger than the adjacent laterals, (4.5-)9.0-15.0 cm long by (1.5-) 3.0-5.0 cm broad. Pseudostipular leaves semiovate, (1.0-)1.5-2.5 cm long. Inflorescence terminal and lateral, cymose paniculate, very branched, (10-)20-45(-55)-flowered, or more (Fig. 109); peduncle short and thick, (1.5-)2.4-4.5 cm long, pigmented and glabrous like the pedicels and the calyx; pedicels short, 10-20(-25) mm long, muriculate in the upper part, articulated usually 3-4 mm below base of calyx. Calyx asymmetrical, fleshy, small, 4-5 mm long, lobes ovate-lanceolate to ovate-triangular with an apiculateapex. Corolla rotate, medium to large, 3.0-3.5 cm in dia., pale blue with a narrow white border that extends from the acumen of the petals toward the apex of the light yellow internal star; acumens of the corolla 2.5 mm long, puberulent; the apex subcuculate. Anthers lanceolate, 5.5-6.0 mm

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* I have maintained the name *Solanum ingaefolium*, type species of the Series Ingaefolia that I proposed in 1959. This name is registered correctly in the Gray Card Index, which records and maintains the Latin names of plants in the New World published since 1885.

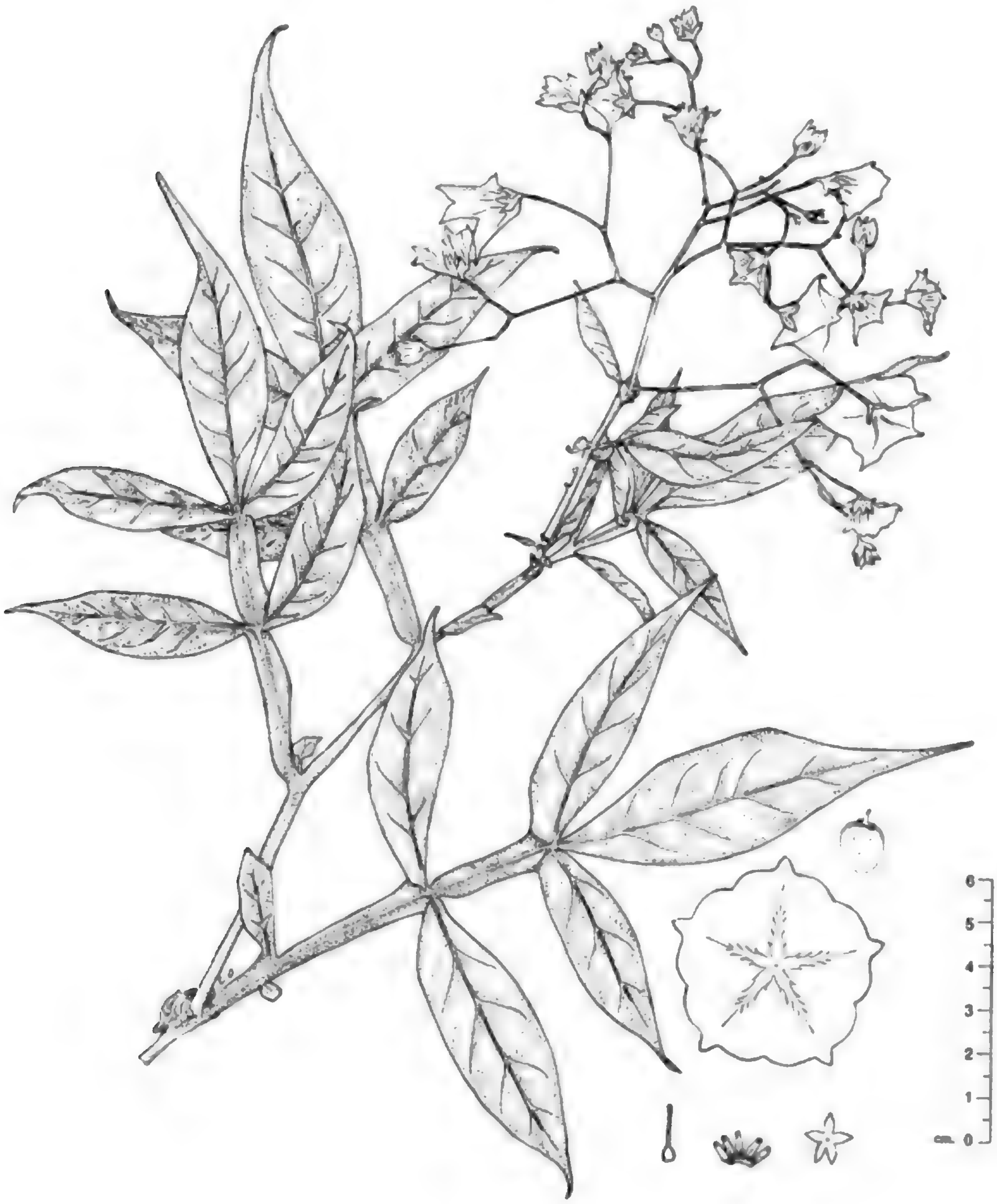


Figure 108. *Solanum ingaefolium* (*Ochoa 2336*).

long by 1.6 mm broad; filaments short, 1 mm or less long, glabrous. Style 9-10 mm long, thick, exerted 3 mm, papillose along the lower one-third of it length; stigma capitate, inconspicuous. Ovary broadly ovoid. Fruit ovoid to ovoid, green, small, 1.5 cm long (Fig. 110). Chromosome Number: 2n=24. EBN=1.

Local Name: *Papa de Monte*.

Type: PERU. Department Piura, Province Ayabaca, mountains of Cuyas, 2800 m alt., near Ayabaca, among moist forests of trees and shrubs, 17 June 1952, C. *Ochoa 1765* (holotype OCH, isotypes LE, P, US).

The type species of this series, *S. ingaefolium* (Art.22.4 of the ICBN) was redescribed by Dr. Correll on October 25, 1962, or two years following my original diagnosis of this species. *S. ingaefolium* is one of the more exotic tuber-bearing species of this section. It has few characters in common with other wild and cultivated potatoes. Some of its more unique attributes include it extraordinarily vigorous habit, very large tubers, and the wide and peculiarily formed wings of the leaf rachis. These wings can be up to 8-10 mm wide in the area of the rachis immediately below the first pair of decurrent leaflets, afterwhich they narrow imperceptably as they run down to the second pair, and in like manner may continue to run down between the third or fourth pairs of leaflets if present, and, finally, follow the petiole down to its point of attachment on the stem.

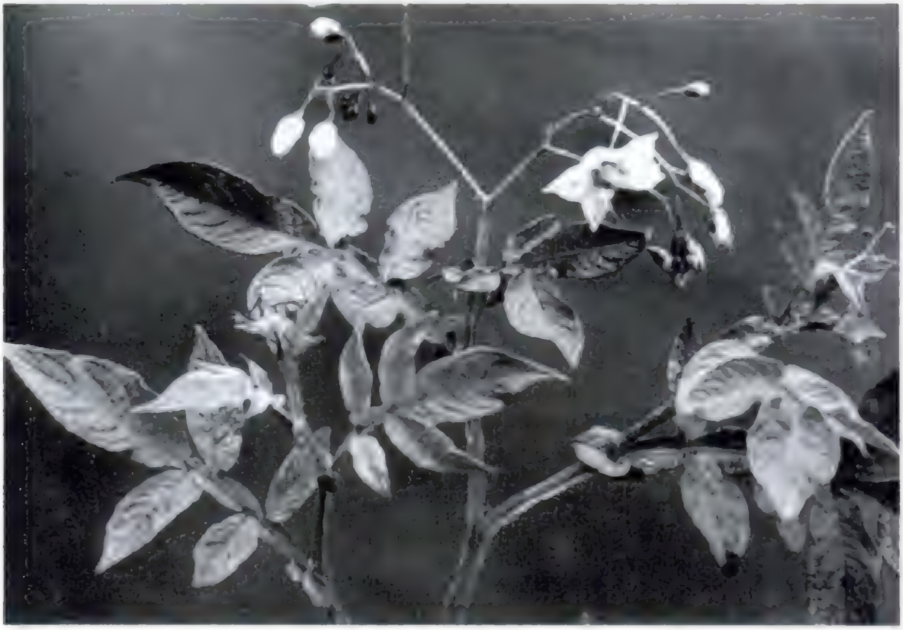


Figure 109. Upper portion of *Solanum ingaefolium* (*Ochoa 1765*, holotype).

Unfortunately, this species is on the verge of extinction. During the writer's last visit to the Cuyas mountains, the type locality of *S. ingaefolium*, I checked on the process of destruction of the natural vegetation which I earlier had observed on my visits to the region in May of 1960 and April of 1977. I found there was an increase in the number of grazing animals and the human population had founded a new village, or "pueblo joven," scarcely 3 km from Cuyas, this dedicated to the raising of hogs, which are predators par excellence. In this manner, the vegetation of the Cuyas highlands which I knew in 1952 had disappeared almost com-

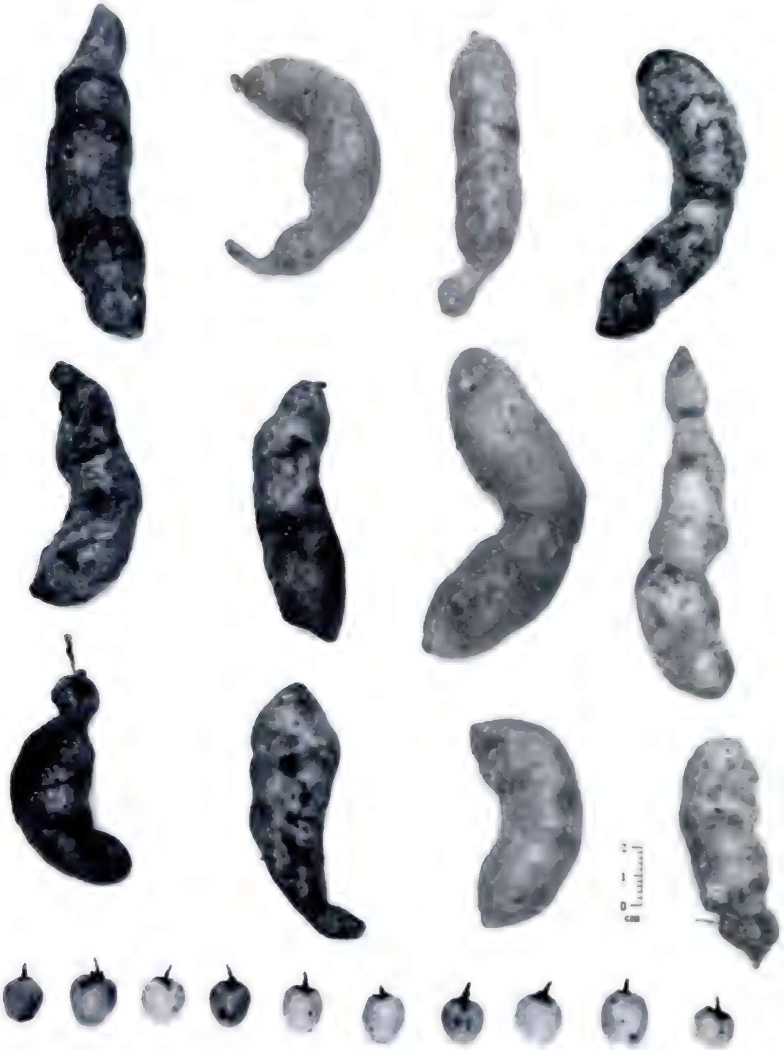


Figure 110. Tubers and fruits of *Solanum ingaefolium*, collected at a site known as Cumaccha (ca. 1800 m alt.), at the foot of Cerro Calvario, Piura, August 20, 1968.

pletely. All that remained was the natural flora of trees, shrubs and herbs which covered an apparently inaccessible steep cliff of a quebrada, and even that is probably no longer in existence today! Above Cuyas is Cerro Pachas, some 3000 m alt., formerly covered with virgin vegetation, but today totally denuded and topped with an enormous television antenna.

During the aforementioned visit to Cuyas, the writer also visited the mountains of Yantuma (about 6 km northeast of Ayabaca) and the highlands of Llaguanguish (some 8 km northwest) and discovered approximately the same amount of erosional effects to the native landscape that were observed at Cuyas. However, a few relic stands of forest remained, especially at Yantuma, and it is at the latter place where a few rather poor samples of *S. ingaefolium* where located between 2500 and 2600 m.

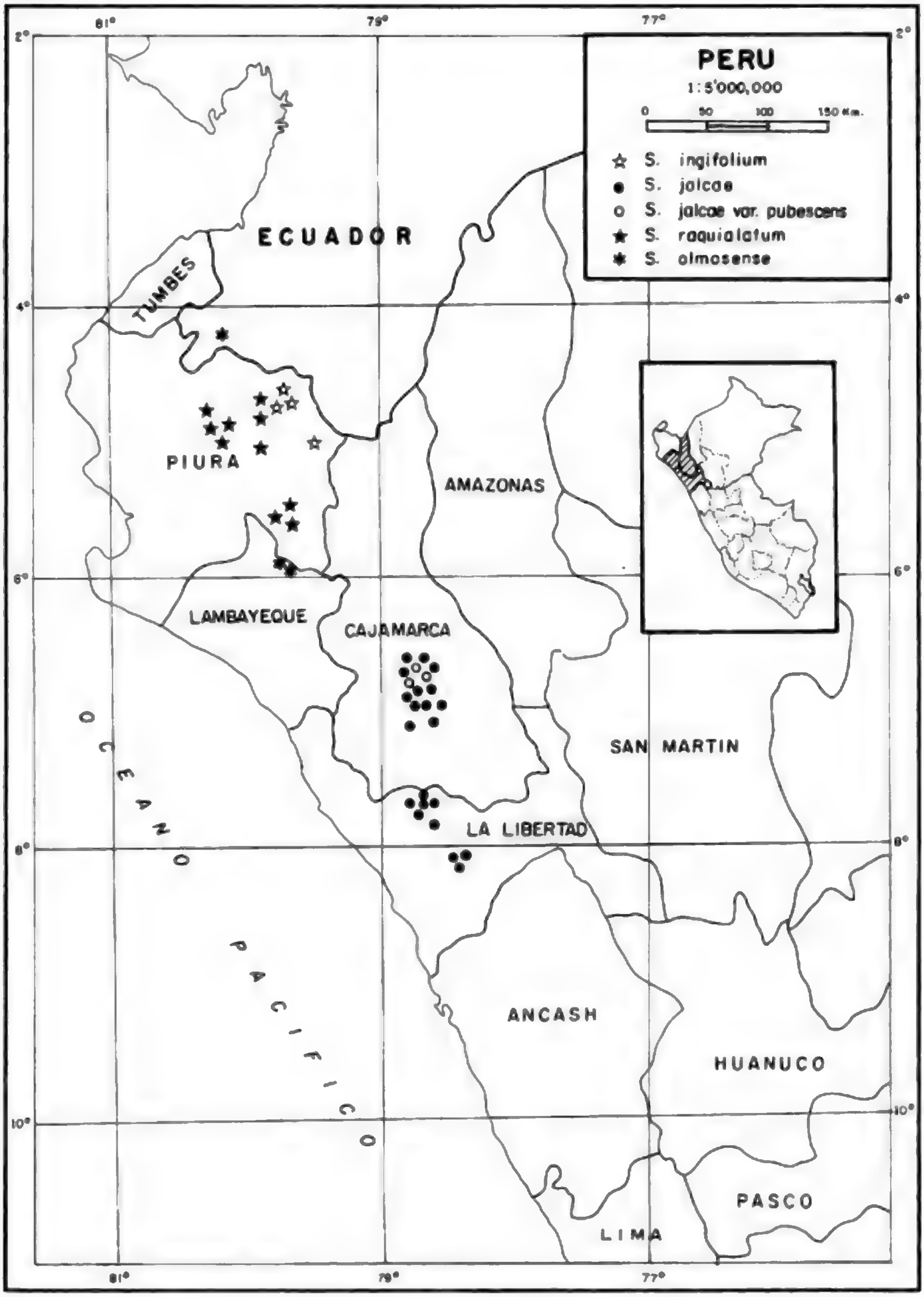
Affinities

Solanum ingaefolium appears to be related to *S. raquialatum* by virtue of the winged leaf rachis, which is fairly similar in both species. However, the two species differ notably in plant habit, vigor, tuber size, corolla color and, above all, in the shape and dissection of their leaves. The leaves of *S. ingaefolium* are less divided, have fewer interjected leaflets and broader wings, and are borne on much longer petioles. Both species appear to be related to some extent to *S. jalcae* as well.

Habitat and Distribution

Solanum ingaefolium grows commonly along the edges of very moist forests of trees and shrubs that contain a rich understory of many herbs, including *Begonia*, *Calceolaria*, *Cedrela*, *Chusquea*, *Lupinus*, *Rubus* and a creamy-white flowered *Cajophora* sp., as well as many ferns, melastomes, composites and various non tuber-bearing species of *Solanum*.

This species is known only from the Province of Ayabaca in the Department of Piura in northern Peru. Its northernmost limits lie in the mountains of Cuyas (04°38' S and 79°43' W), while its southern boundaries terminate in the highlands of Moray near Frías (04°55' S and 79°57' W). Altitudinally, this species ranges from 2400 m in the Cerro Mijal of the highlands of Frías to 3000 m in the mountains of Llaguanguish near Cuyas and Ayabaca (Map 12).



Map 12. Distribution of *S. ingaefolium*, *S. jalcae*, *S. jalcae* var. *pubescens*, *S. raquialatum* and *S. olmosense*.

Specimens Examined

Department Piura

Province Ayabaca: Cuyas Mountain, 2800 m alt., near Ayabaca, in forests of trees and shrubs, in very moist black soils, tubers large, 12-15 cm long, long subcylindrical, white, flowers pale violet or lilac, 17 June 1952, C. *Ochoa 1765* (LE, OCH, P, US, type collection of *S. ingaefolium*). Cuyas Mountain, 2980 m alt., near Ayabaca, in scrub or along forest margins, on black moist soils, n.v. *Papa de Monte*, 8 May 1960, C. *Ochoa 2332* (OCH) and *2333* (topotypes of *S. ingaefolium* MOL, OCH). Lower slopes of Llaguanguish Mountain, 2400 m alt., near Chonta northwest of Pingola, about 4 km from Ayabaca, among forest shrubs and trees, 8 May 1960, C. *Ochoa 2336*, 2n=24 (MOL, OCH, US). Mountain of the Cross of Cuyas, grazing field of José Aguilera Pauca, 2560 m alt., 12 May 1974, Z. *Huamán 937* (CIP). Cuyas Mountain, 2400 m alt., near Ayabaca, in shrub forest, plants to 2 m tall, robust, leaves large, little divided, flowers lilac, tubers up to 15 cm long and 3.5-4.5 cm thick, white, 17 April 1977, C. *Ochoa 11614*, 2n=24 (topotype of *S. ingaefolium* OCH). Maray, near Frías, 2600 m alt., in scrub, plants very vigorous, 1-2 m tall, stems up to 3 cm in dia. at base, slightly triangular, wingless, stolons about 1 m long and 3-4 mm in dia., 30 April-14 May 1980, C. *Ochoa 13943* (OCH, US). Tuno, near Poclus Alto, between Frías and Comuna, plants still without flowers, 2 May 1980, C. *Ochoa 13948* (CIP, OCH). Lower slopes of Cerro Mijal, 3000-3200 m alt., 6 May 1980, C. *Ochoa 13952*, 2n=24 (CIP, GH, MOL, OCH), *13953*, 2n=24 (CIP, GH, MOL, OCH, US), and *13955* (CIP, GH, MOL, OCH, US). Cuyas Mountain, 2650 m alt., near Ayabaca, 23 June 1984, C. *Ochoa 15770* (topotypes of *S. ingaefolium* CIP, OCH). Mountains of Yantuma, 2600 m alt., on the banks of the stream Llagues, 24 June 1984, C. *Ochoa 15788* (CIP, F, GH, MOL, OCH, US).

Table 23. Fertility of *Solanum ingaefolium* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	INGAEFOLIA	× *S. raquialatum*	57(31)	21(16)	45(23)
24	2	CONICIBACCATA	× *S. chomatophilum*	8(6)	8(2)	2(58)
24	2	TUBEROSA	× *S. huarochiriense*	6	5	22

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

As expected, the crosses of *S. ingaefolium* with *S. raquialatum* were easily made since both species have an EBN value of 1. However, the average number of seeds obtained per berry was fairly low. Plants of the F_1 population resembled *S. raquialatum* in habit and leaf dissection, although the rachis was much more narrowly winged than typically occurs in that species.

Many more seeds were obtained with *S. chomatophilum* when *S. ingaefolium* was used as the pistillate parent, rather than as the staminate parent. Plants of the F_1 generation were generally 60 cm tall and produced leaves having 1-2 pairs of leaflets and some interjected leaflets, or, in some cases were without interjected leaflets. In all, the terminal leaflet was much larger than the laterals, and the rachis was very narrowly winged.

The unilateral crosses involving *S. huarochiriense* were also compatible despite their differing EBN values. However, only a low average number of seeds per berry were obtained in this case.

Table 24. Collections (OCH) used in *Solanum ingaefolium* fertility studies.

CONICIBACCATA	TUBEROSA
S. chomatophilum 11061, 14496, 14786 14787	*S. huarochiriense* 14525
INGAEFOLIA	
S. ingaefolium 11614, 13952	
S. raquialatum 13950, 13951, 13958	

24. *Solanum jalcae* Ochoa, Agronomía, Lima, 19:167-169, Figs. 1-2, 1954.

Figs. 111-114; Map 12; Plate X.

Plant glabrous, decumbent-ascending to erect-ascending, somewhat rosette forming at base, (20-)30-40(-50) cm tall. Stem slightly pigmented, generally simple, rhizomatous, 5-7 mm in dia., internodes short, 0.5-3.0 cm long and somewhat sinuous in the basal third; stem very narrowly winged or wingless, glabrous or glabrescent. Plant stoloniferous and tuber-bearing, stolons 30-50 cm or more long, white, fleshy; tubers moniliform, small, 1.5-2.5(-4) cm long, globose to ovoid or long-cylindrical, white (Fig. 113). Leaves imparipinnate, dark green and slightly vernicose above, lighter green to green-violet below, (5.5-)12.0-20.0 cm long by (2-) 8-14 cm broad, with 2-3(-4) pairs of leaflets and (0-)1-2(-3) or more pairs of interjected leaflets, petioles short, 0.5-1.0 cm long, the rachis notably winged. Wings broadest between the terminal leaflet and the first pair of leaflets, diminishing gradually in breadth between the second pair of leaflets and any pairs which may follow, and narrowest along the petiole. Terminal leaflet larger or much larger than the laterals, (2.5-)5.0-7.0 cm long by (1.4-)3.0-5.5 broad, ovate-lanceolate or broadly elliptic-lanceolate, occasionally rhombic-lanceolate, the apex usually obtuse and the base broadly cuneate and decurrent; lateral leaflets (0.5-)3.0-5.5 cm long by (0.4-)2.0-3.5 cm broad, broadly or narrowly elliptic to ovate-elliptic, the apex obtuse to slightly pointed and the base decurrent, conspicuously winged lateral to the length of the rachis. Pseudostipular leaves suborbicular to broadly falcate, small, 6-8(-10) cm long by 4-5(-6) cm broad. Inflorescence cymose-paniculate, 10-15(-25)-flowered; peduncle occasionally bracted halfway between the base and the first fork, 5-12 cm long, glabrous, pigmented like the pedicels and calyx, slender; pedicels 30 mm long, articulated 4-5 mm below the calyx. Calyx asymmetrical, very dark purple, 6.0-6.5 mm long; lobes ovate to ovate-triangular with an obtuse to slightly pointed apex. Corolla rotate, 3.0-3.5 cm in dia., somewhat pleated, with short lobes and acumens, blue with a dark lilac internal star (Fig. 112). Anthers broadly lanceolate, 6-7 mm long, filaments short and thick, about 1 mm long, glabrous. Style 11-12 mm long, exerted 3.0-3.5 mm, papillose beneath the midpoint; stigma ovoid, somewhat thicker at apex of style. Ovary ovoid, light green with the upper third pigmented lilac. Fruit ovoid, 1.5-1.8 cm long, light green and marked with darker green streaks or occasionally the upper third with a tinge of light purple. Chromosome Number: 2n=24. EBN=2.

Local name: *Papa de Zorro*

Type: PERU. Department La Libertad, Province Otuzco, heading up from Hacienda Motil to the *jalcas* along the road to the mine deposits of Shorey, 3300-3400 m alt., 11 May 1952, *C. Ochoa 1433* (holotype OCH, isotypes GH, LE, MOL, US).

Affinities

Solanum jalcae is closely related to another species from northern Peru, *S. chomatophilum*. Both species grow at high altitudes and are essentially glabrous. The foliage of these two species is dark green and slightly brilliant above and either light green or pale violet below. Moreover, and most importantly, these two species have calyces that are very similar in size and shape.

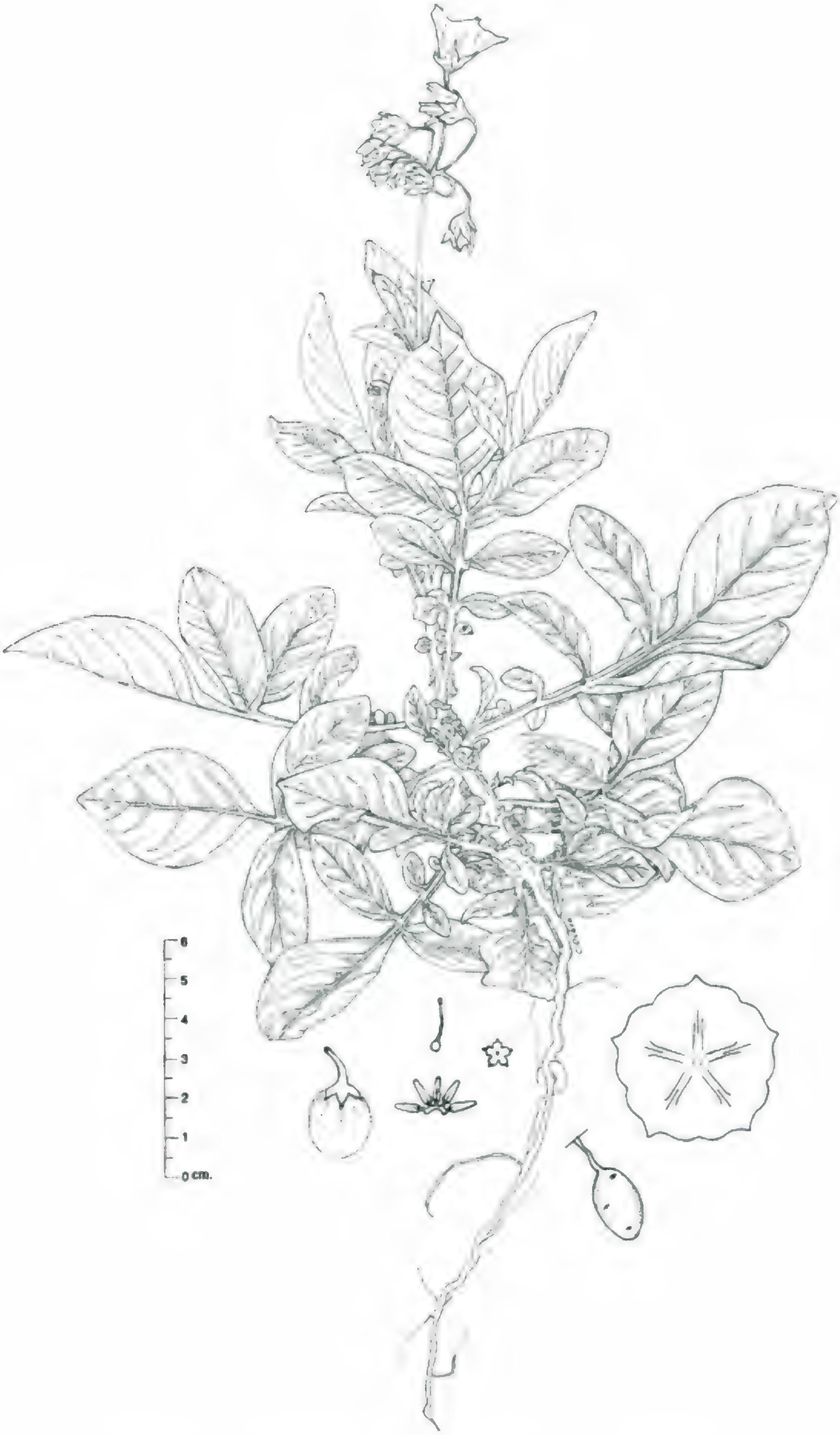


Figure 111. *Solanum jalcae* (*Ochoa 1433,* holotype).

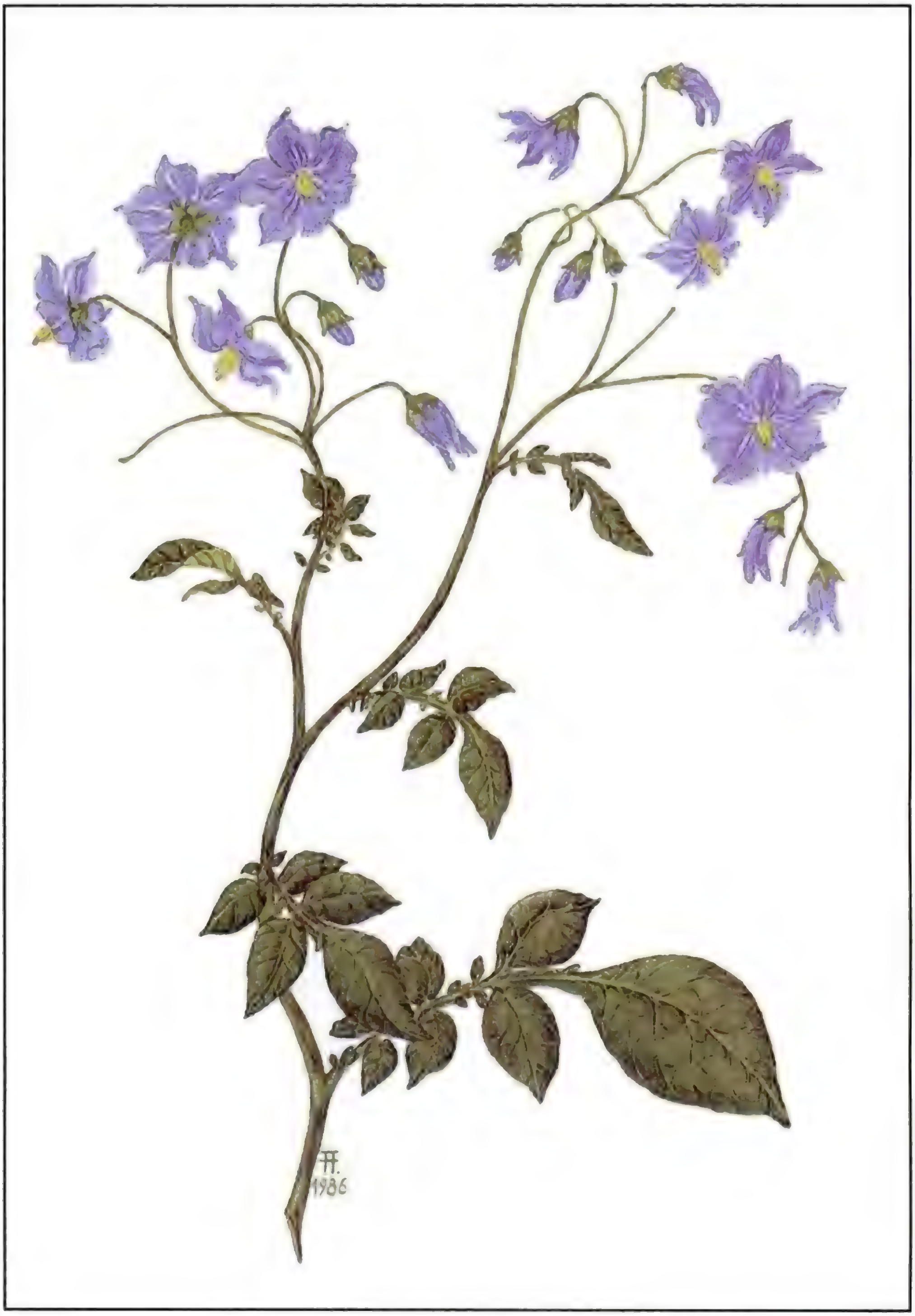


Plate X. *Solanum jalcae* Ochoa.

Habitat and Distribution

Solanum jalcae grows commonly in the phytogeographic formation known as *jalca* in northern Peru. The sparse vegetation of these plant formations occur on high, cool, elevated plains dissected by steep-walled quebradas, generally at altitudes ranging between 3400 and 4200 m.

This species is presently known only from the Department and Province of Cajamarca and the Provinces of Otuzco and Santiago de Chuco of the Department of La Libertad in northern Peru, at altitudes between 3300 and 4000 m. It is found among grasses and creeping plants or in quebradas or seepage areas of rocky cliffs (Fig. 114), associated, at times, with *S. chomatophilum* and *Lupinus* sp. (Map 12).

Specimens Examined

Department Cajamarca

Province Cajamarca: Cerro Entenador, 3520 m alt., *jalcas* of Hacienda Porcón, near Cajamarca, in grassland, flowers blue, 21 May 1952, C. *Ochoa 1512* (MOL, OCH, USM). *Jalcas* of Hacienda Porcón, 3500 m alt., 2 April 1960, *C. Ochoa 2289*, 2n=24 (OCH). Cumbe Mayo, 3400 m alt., flowers blue, tubers small, 14 June 1970, *I. Sánchez Vega and W. Ruiz Vigo 595* (UNTC). *Jalcas* of Porcón, 3400 m alt., before the hamlet of Hacienda Porcón, berries round to ovoid, marbled light green with dark green stripes, associated with *Poa*, *Stipa*, *Hypericum* and *Cajophora*, 19 May 1982, *C. Ochoa 14782*, 2n=24 (OCH, from the original plant) and (CIP, MOL, OCH, USM, from plants grown in the greenhouse at Huancayo). Yanacocha, Cerro Vizcachas, 4040 m alt., rocky zone (by landslide), annual herb, flowers blue-violet, tubers small, 15 May 1991, *J. Cabanillas Soriano 357* (MO, UNTC). Cerro Campanario, 3580 m alt., heading down from Porcón to San Pablo, 29 March 1992, C. *Ochoa and A. Salas 16013* (OCH, floral dissection only). Cerro Cristal, 3450 m alt., facing Cerro Campanario, on the Porcón-San Pablo road, 29 March 1992, C. *Ochoa and A. Salas 16018* (CIP, OCH). Cerro Llalladen, 3840 m alt., at the entrance of a cave on the detour to Negritos at km 52 along the Cajamarca-Hualgayoc road, 29 March 1992, *C. Ochoa and A. Salas 16045* (CIP, OCH). Cerro Molino, 3580 m alt., *jalcas* of Porcón, 2 June 1992, C. *Ochoa and A. Salas 16141* (CIP, OCH, from plants grown in the greenhouse at Huancayo).

Department La Libertad

Province Otuzco: *Jalcas* of Hacienda Motil, 3100-3300 m alt., near the right margin of the main road, heading up from Motil to the mine deposits of Shorey, leaves dark green above, pigmented violet below, rachis and petioles

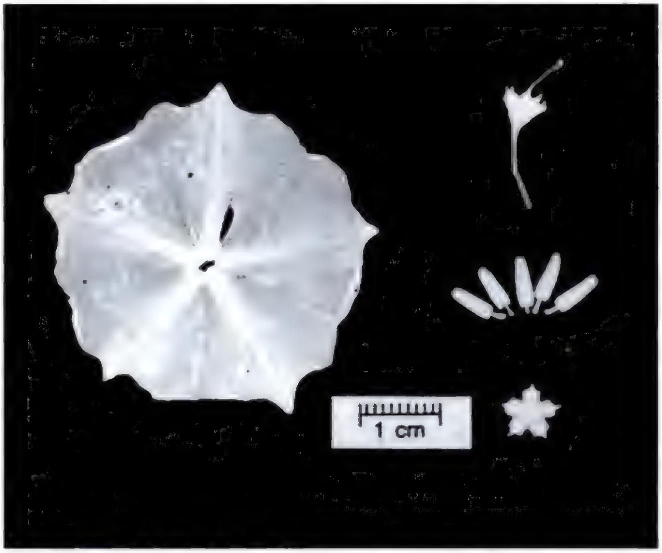


Figure 112. Floral dissection of *Solanum jalcae* (*Ochoa 1433*, holotype).

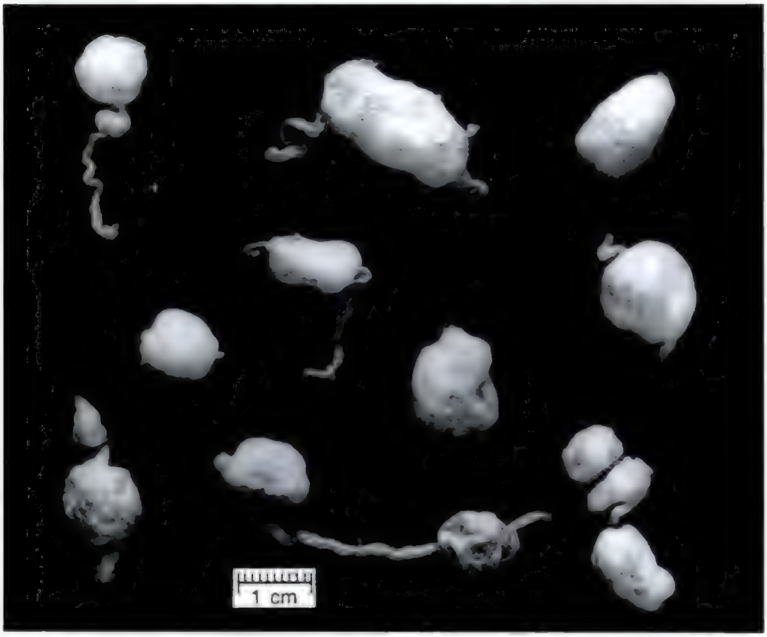


Figure 113. Tubers of *Solanum jalcae,* collected in the *jalcas* of Porcón, Cajamarca, May 1982 (*Ochoa 14782*).

conspicuously winged, 14 May 1952, *C. Ochoa 1433* (holotype OCH, isotypes GH, LE, MOL, US, type collection of *S. jalcae*), *1434* and *1435*, 2n=24 (paratypes OCH). In the *jalcas* of the Haciendas Chota and Motil, on the road toward Shorey, 3850 m alt., between old enclosures of stone and earth, near the road, 21 May 1963, *C. Ochoa 2502* (MOL, OCH, USM). *Jalcas*, above the hamlet of Hacienda Motil, 3280 m alt., among *Puya* sp., *Loasa* sp. and large tufts of *Stipa*, 24 March 1964, *C. Ochoa and J.G. Hawkes 2552* (OCH). *Jalcas* on the Hacienda Motil, 3380 m alt., on the Motil-Shorey road, in stony soils, 10 March 1971, *C. Ochoa 2954* (topotypes of *S. jalcae*). Cerro Ragache (Salpo), 3200 m alt., tuber-bearing herb with purple flowers, at the base of rocks, n.v. *Papa de*

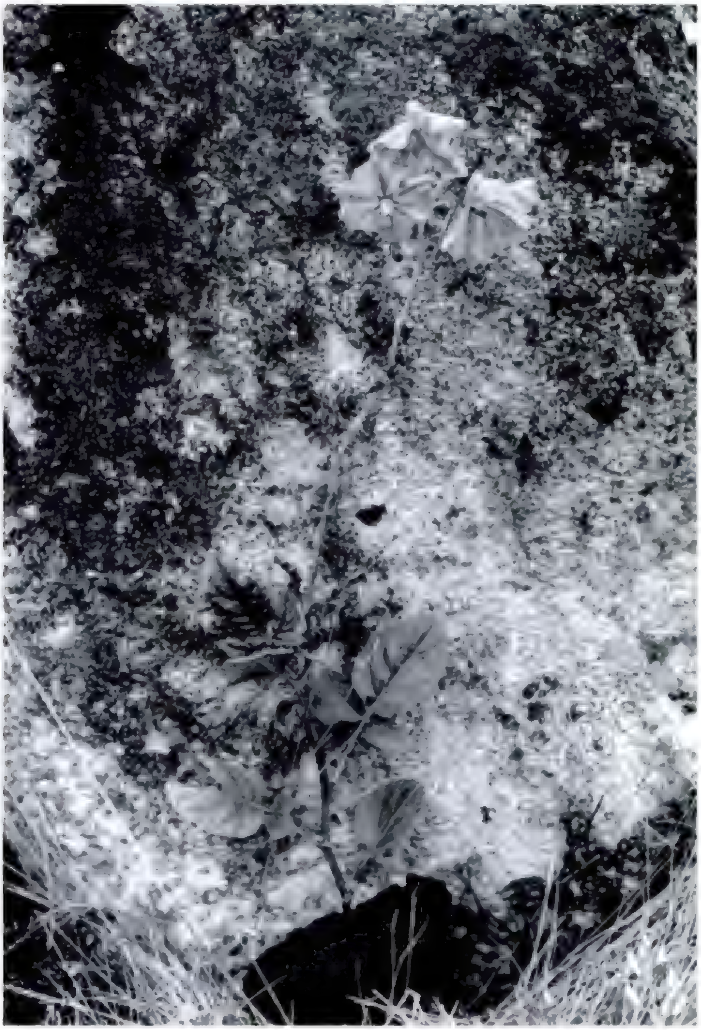


Figure 114. *Solanum jalcae* in its native habitat, the *jalcas* of Porcón, Cajamarca, May 1982.

Zorro, 23 May 1984, *A. Sagástegui, M. Diestra and S. Leiva 11585* (OCH, HUT). Near Laguna San Lorenzo, Distr. of Usquil, *ca.* 3250 m alt., April 1978, *C. Ochoa 12535* (OCH). Lower slopes of Cerro Sango, eastern side, 3900 m alt., between Motil and Quiruvilca, growing near *Solanum chomatophilum*, 9 May 1979, *C. Ochoa 13344*, 2n=24 (CIP, OCH, USM, from original plants) and (CIP, OCH, from plants grown in the greenhouse at Huancayo).

Province Santiago de Chuco: On seepage slope a few km below Quiruvilca, 3500 m alt., plant rhizomatous, flowers dull lavender, rotate-stellate, 27 March 1960, *D.S. Correll and E.E. Smith P941* (LL, NY, UC, US). *Jalcas* of Sogarbal, 3700 m alt., Santiago de Chuco, 24 May 1963, *C. Ochoa 2512* (OCH). San Felipe, 3600 m alt., between Motil and Shorey, amid enormous rocks, tubers ovoid to elongated, white, small, 1.0-1.5 cm long, 7 July 1981, *C. Ochoa 14488*, 2n=24 (CIP, OCH, USM). Left bank of the Moche River, in *jalca* 3600 m alt., about 3 km from San Felipe, among rocks and large stones, single and moniliform tubers, tubers round and long subcylindrical, 8 July 1981, *C. Ochoa 14490* (CIP, OCH, USM, from original plants) and (CIP, OCH, USM, from plants grown at La Molina, Lima).

Table 25. Fertility of *Solanum jalcae* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	INGAEFOLIA	× *S. raquialatum*	44(28)	27(22)	73(181)
24	1	LIGNICAULIA	× *S. lignicaule*	5	1	10
24	1	MEGISTACROLOBUM	× *S. dolichocremastrum*	13(8)	12(30	51(21)
24	1	PIURANA	× *S. hypacrarthrum*	10	4	0
24	1	TUBEROSA	× *S. wittmackii*	8(2)	0(1)	0(30)
24	2	CONICIBACCATA	× *S. chomatophilum*	126(200)	102(161)	58(84)
			× *S. contumazaense*	2	0	0
24	2	MEGISTACROLOBA	× *S. megistacrolobum*	3	3	72
			× *S. sogarandinum*	16(9)	15(4)	44(85)
24	2	PIURANA	× *S. chiquidenum*	6	6	0
24	2	TUBEROSA	× *S. bukasovii*	12(16)	0(11)	0(0)
			× *S. huarochiriense*	36(27)	15(23)	100(40)
			× *S. medians* var. *autumnale*-2x	12(11)	5(5)	60(20)
			× *S. multiinterruptum*	6	6	72

			× *S. phureja*	87	71	0
			× *S. saxatilis*	6	1	50
48	2	ACAULIA	× *S. acaule*	29	0	0
72	4	ACAULIA	× *S. albicans*	50	26	0

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

The results of crosses of *S. jalcae* with diploid species (2n=24) of EBN= 1 and EBN=2, tetraploids (2n=48) of EBN=2 and hexaploids (2n=72) of EBN=4 are given in Table 25, while the materials used in these experiments are shown in Table 26.

It is of interest to note that crosses of *S. jalcae* with *S. raquialatum*, two species that have different EBN values but are members of the same series, gave the highest average number of seeds per berry.

Reciprocal crosses of *S. jalcae* with *S. chomatophilum* and *S. huarochiriense* also yielded a fairly high number of seeds per berry, even though the two series involved in these crosses are very different from one another. However, only pathenocarpic seeds were obtained in crosses of *S. jalcae* with either *S. phureja* or *S. albicans*, though a large number of berries were formed in each case.

Table 26. Collections (OCH) used in *Solanum jalcae* fertility studies.

ACAULIA
S. acaule 11602, 11603
S. albicans 12091

CONICIBACCATA
S. chomatophilum 11061, 11856, 13196, 13198, 13199, 13208, 13210, 13307, 13319, 13325, 13332, 14786, 14787, 14788
S. contumazaense 14751

INGAEFOLIA
S. jalcae 13004, 13344, 14488, 14490 14782, 14785, 15163
S. raquialatum 13937, 13958

LIGNICAULIA
S. lignicaule 13514

MEGISTACROLOBA
S. dolichocremastrum 12072, 12074
S. megistacrolobum 13544
S. sogarandinum 13006, 13324

PIURANA
S. chiquidenum 13967
S. hypacrarthrum 14715

TUBEROSA
S. bukasovii 11330, 15202
S. huarochiriense 14525, 15193
S. medians-2x 11637
S. multiinterruptum 11693
S. phureja 15091, 15130, 15134, 15136
S. saxatilis 15082
S. wittmackii 13184, 13215

24a. *Solanum jalcae* Ochoa var. *pubescens* Corr.

Fig. 115; Map 12.

The variety *pubescens* differs notably from the type of this species by the greater pilosity of the plant and especially by the dense pubescence of the stem with white or straw-colored hairs 3 mm long. Also, the leaves of this variety are generally more divided, and these frequently have more numerous interjected leaflets.

Specimens Examined:

Department Cajamarca

Province Cajamarca: *Jalcas* of Hacienda Porcón, 3480 m alt., in grassland, 16 June 1959, *C. Ochoa 2167* (MOL, OCH). Rocky grassy open slope, Hacienda Porcón, mountains near entrance, 3550 m alt., north of Cajamarca, flowers

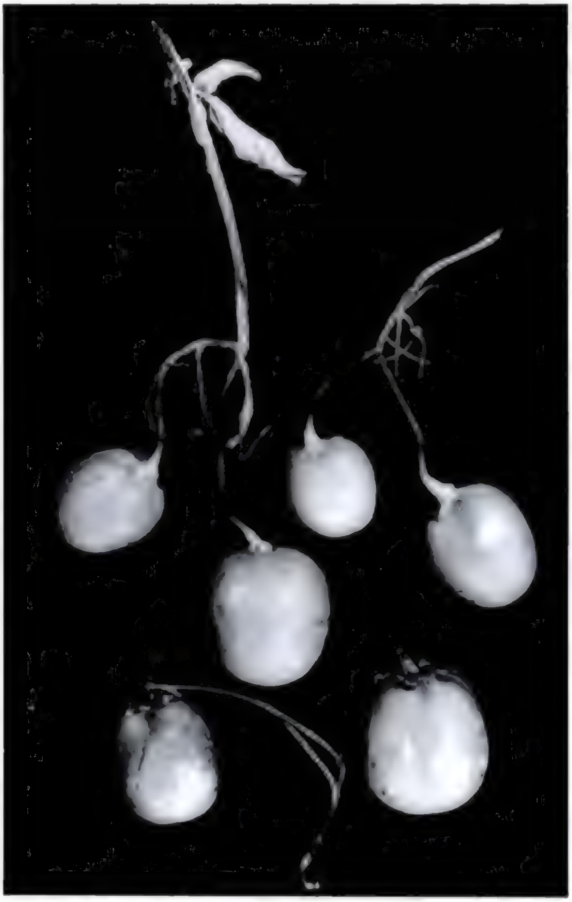


Figure 115. *Solanum jalcae* var. *pubescens* (*Ochoa and Salas 16141*).

bluish-purple, broadly rotate to rotate-substellate, tubers small, whitish, moniliform, 25 March 1960, *D.S. Correll and E.E. Smith P866* (LL, NY, USM, type collection of *S. jalcae* var. *pubescens*). Rocky grassy open slope, Hacienda Porcón, mountains near entrance, 3550 m alt., north of Cajamarca, leaves purplish beneath, tubers small, 25 March 1960, *D.S. Correll and E.E. Smith P867* (K, LL, US). *Jalcas* of Hacienda Porcón, 3500 m alt., plant very pilose but leaves little divided, 29 March 1964, *C. Ochoa and J.G. Hawkes 2564* (MOL, OCH). Heading down from the *jalcas* of Porcón toward the hamlet of the hacienda, 3400 m alt., in cold grassland and in poor, moist and gravelly soils, associated with *Weinmannia*, *Lobelia*, *Bidens*, *Gnaphalium*, *Netotriche*, *Stipa*, *Festuca* and *Hypericum*, n.v. for the berry, *lunta*, 19 May 1982, *C. Ochoa 14785*, 2n=24 (OCH, from plants grown in the greenhouse at La Molina, Lima). Poso Seco, 3400 m alt., Distr. San Pablo, on the Porcón road toward Cerro Atokk Saicku and Cerro Molino, plants very pubescent, leaves little to very divided, flowers purple, 29 March 1992, *C. Ochoa and A. Salas 16008* (CIP, OCH). Cerro Campanario, on the Porcón-Cajamarca road, 3580 m alt., among tall trees and grasses, 29 March 1992, *C. Ochoa and A. Salas 16009* (CIP, OCH). Heading down from Cerro Campanario toward Atokk Saicku, 3580 m alt., 29 March 1992, *C. Ochoa and A. Salas 16010* (CIP, OCH) and *16011* (CIP, OCH). China Linda, 3540 m alt., on the Cajamarca-Hualgayoc road, plant somewhat pilose, growing near *S. chomatophilum*, 29 March 1992, *C. Ochoa and A. Salas 16021* (CIP, OCH). Lower part of Cerro Negro, 3650 m alt., at km 28 on the Cajamarca-Hualgayoc road, herb with small tubers, flowers blue-purple, 6 March 1994, *I. Sánchez Vega and M. Cavanillas S. 6856B* (OCH, UNTC).

25. ***Solanum raquialatum*** Ochoa, Agronomía, Lima, 19:172-174, Figs. 6-7, 1954.

Figs. 116-119; Map 12; Plate XI.

Plant erect-ascending, to 2 m tall, usually lower. Stem vigorous, simple or little branched, slightly flexed, very narrowly winged, light green or slightly pigmented. Plant stoloniferous and tuber-bearing, stolons 50-60 cm or more long, 1.5-2.0 mm in dia., tubers long, irregularly cylindrical to subcylindrical or occasionally moniliform (Fig. 119), 10 cm long and 2.0-2.5 cm thick, white with numerous lenticels, small, with superficial and semi-deep eyes. Leaves light green, sparsely pilose above, more finely pubescent on the veins below, imparipinnate, (15-)23-40 cm long by (11-)14.6-27.0 cm broad, with 4-5(-6) pairs of leaflets and 1-3(-5) pairs of poorly defined interjected leaflets; rachis irregular and broadly winged (Fig. 117); petioles short, less than 1 cm long. Leaflets elliptic-lanceolate, the apex pointed or attenuate-acuminate and the base somewhat obliquely broadly cuneate to rounded, shortly petiolulate and strongly decurrent about the basiscopic side; terminal leaflet slightly larger or equal to the laterals, (5.0-)7.5-12.0 cm long by (1.6-)2.7-4.5 cm broad. Pseudostipular leaves broadly falcate, (10-)15-20 mm long by (5-)8-9 mm broad. Inflorescence terminal and lateral, cymose paniculate, 10-15-flowered, or more; peduncle glabrous like the pedicels, short, 4-5 cm long, slender; pedicels long, 20-30 mm, slightly muriculate in the upper part, articulated 3-4 mm below the calyx. Calyx symmetrical, glabrous, small, 3-4 mm long; lobes broadly ovate-lanceolate with apiculate apices and dry membranous margins. Corolla rotate, white, 3 cm in dia.; acumens short and pointed, 1.5-2.0 mm long, with pubescent margins (Fig. 118). Anthers narrowly lanceolate, 7 mm long; filaments 0.5-1.5 mm long, puberulent. Style 10 mm long, exerted 3.5 mm, papillose below the midpoint, the papillae alternating with short, conspicuous, filiform hairs; stigma capitate, very small. Fruit globose to ovoid 1.5-2.0 cm in dia. (Fig. 117), light green. Chromosome Number: 2n=24. EBN=1.

Local Name: *Papa de Wisco* (=Turkey Buzzard Potato).

Type: PERU. Department Piura, Province Huancabamba, quebradas west of Canchaque, common in weedy growths, clay, 1200 m alt., 4 April 1939, *H.E. Stork 11394* (holotype UC, isotypes G, GH, NA).

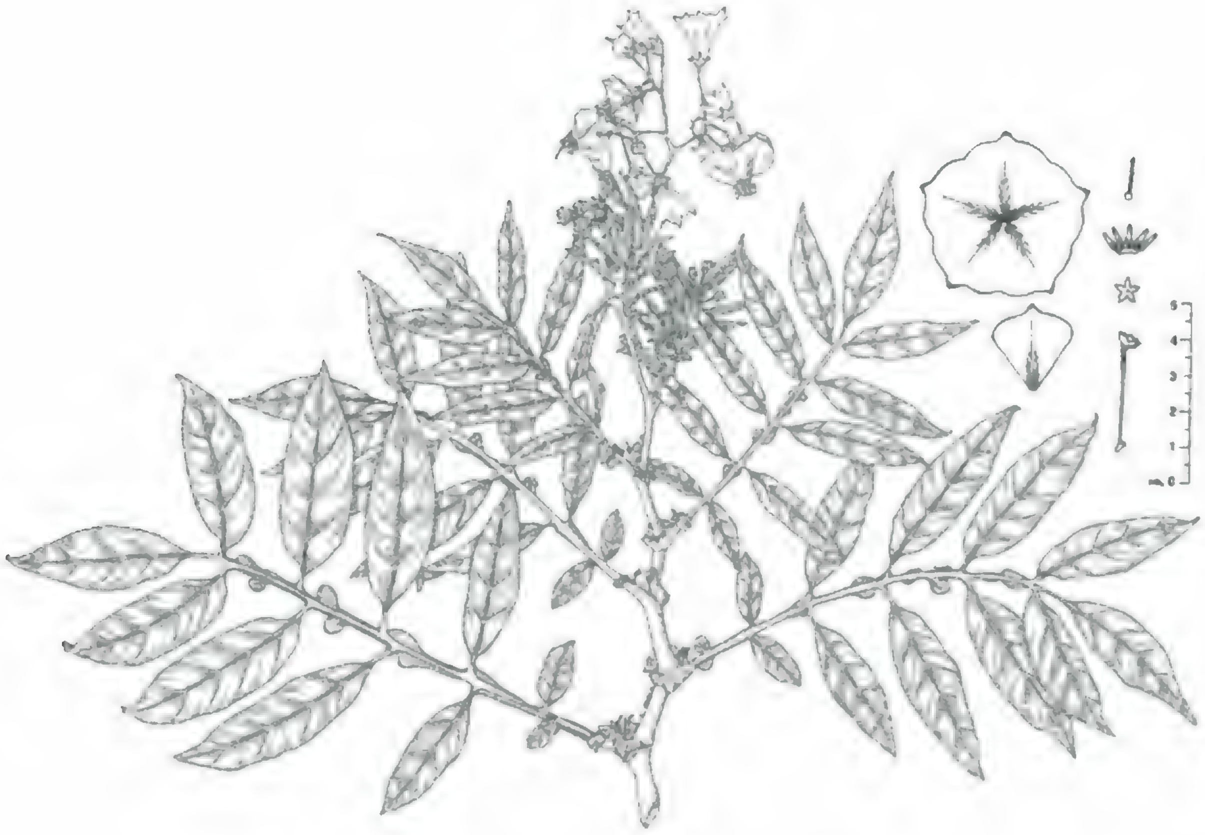


Figure 116. *Solanum raquialatum* (*Ochoa 13947*, Plate 1).

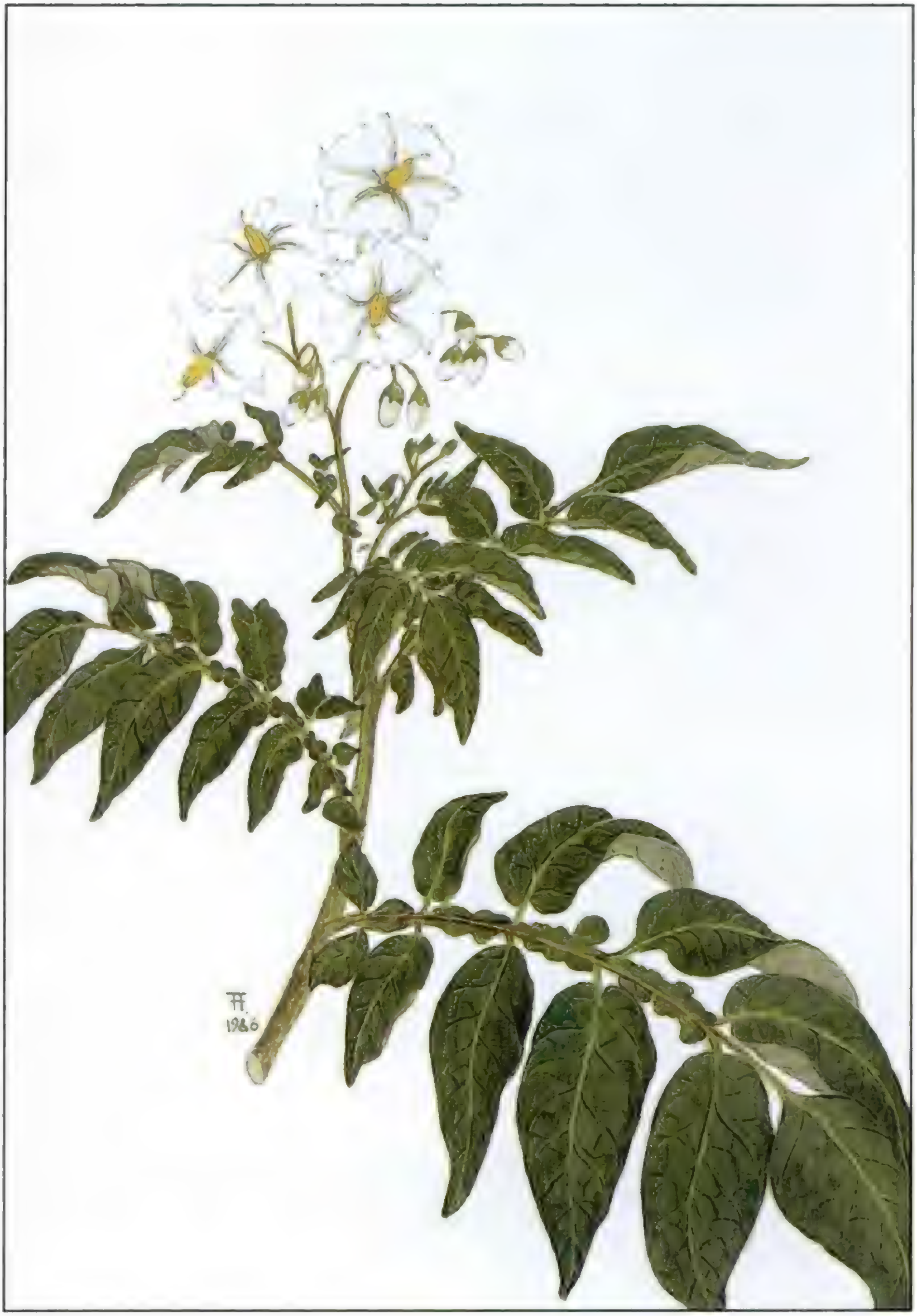


Plate XI. *Solanum raquialatum* Ochoa.

When the original diagnosis of *S. raquialatum* was made, the author had in his disposition only the unicate specimen of Stork (*#11394*) which is stored in the Department of Botany Herbarium at the University of California. Thus, this specimen constitutes today the holotype of *S. raquialatum* as required by the *International Code of Botanical Nomenclature* (see Art. 9.1, Tokyo Code, 1994).

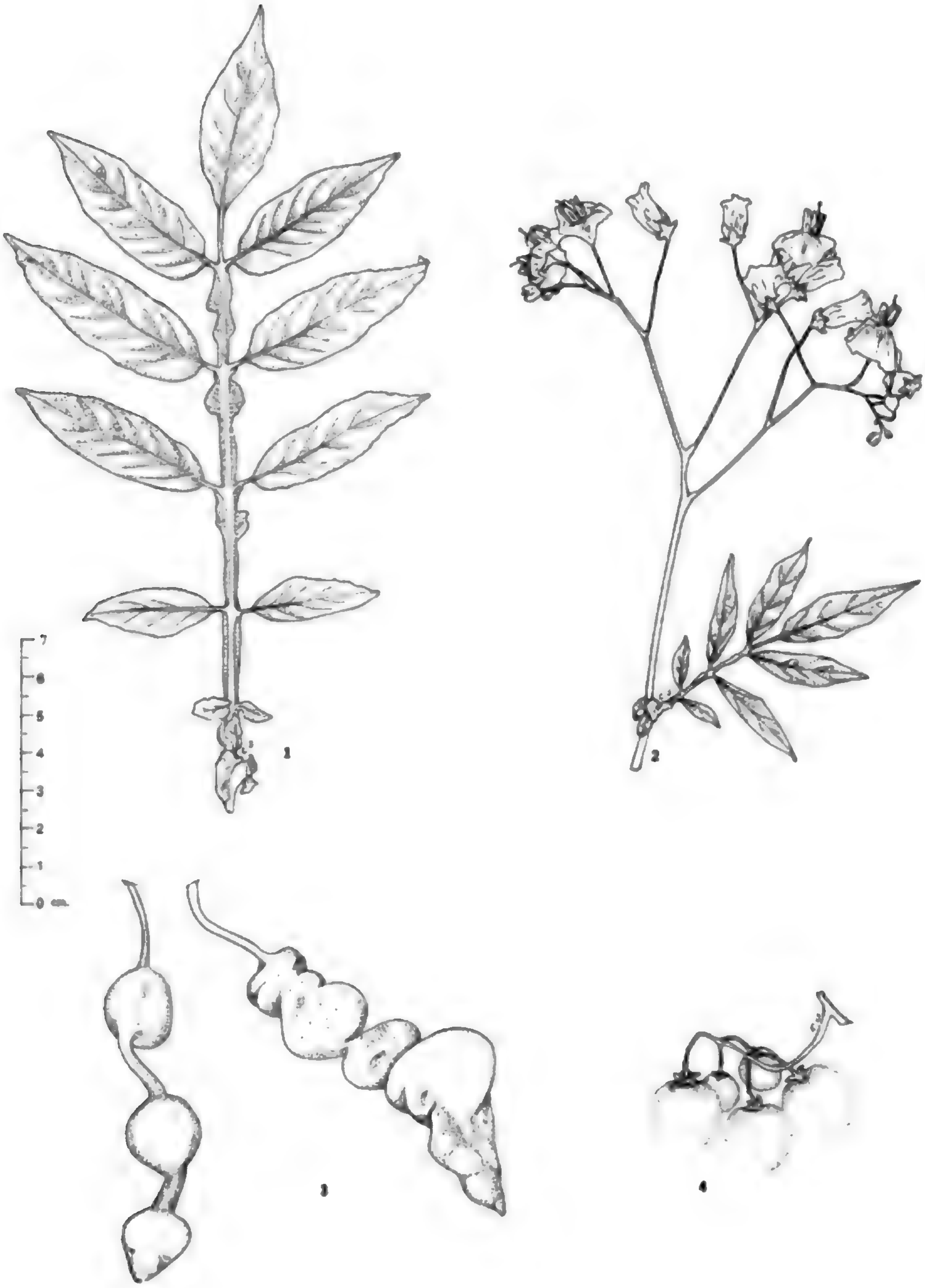


Figure 117. *Solanum raquialatum* (*Ochoa 13947*, Plate 2).

It is possible that the quebradas that Stork cites in the label information given on his collection No. *11394* refers to the region known as *La Afiladera*, 1200 m alt., near Cerro Campana and about 5 km from Canchaque, which is at an altitude of about 1680 m. In the writer's visit to these quebradas on the 2 May 1960, no wild potato species were encountered. Nevertheless, in the immediate vicinity of Cerro Mishihuaca, a few kilometers north-northeast of Canchaque, the author discovered *S. raquialatum* growing amongst shrubs in a very moist habitat, and in open fields he found *S. mochiquense*, both at elevations of about 1900 m.

Affinities

Through its broadly winged leaf rachis and its large tubers, this species shows some relationship to *S. ingaefolium*. Similarly, by the morphology of its winged leaf rachis this species bears some resemblance to *S. olmosense*, but this last species has a stellate corolla and the plant is noticeably much smaller.

Habitat and Distribution

This species grows in very moist forests of trees and shrubs. It prefers soils high in humus and is often found in lush patches of vegetation, growing, frequently, with such shrubs and herbs as *Rubus*, *Calceolaria*, *Chusquea*, *Oxalis* and *Fuchsia*, as well as with various species of melastomes and ferns.

As in the case of *S. ingaefolium*, the distribution of *S. raquialatum* is restricted to the Department of Piura in northern Peru, though, in actuality, this species is more widespread in nature than the former species. It is found in the Provinces of Ayabaca, Huancabamba and Morropón at altitudes between 1350 and 2800 m. Its northern limits occur at Churillo, Province Ayabaca (04°47' S and 79°51' W), while its southern range terminates at Canchaque, Province Huancabamba (05°22' S and 79° 37' W), Map 12.

Specimens Examined

Department Piura

Province Ayabaca: Pucalá, 2240 m alt., south of Frías, May 1980, *C. Ochoa 13937*, 2n=24 (CIP, MOL, OCH, USM). Near Pucalá, 2240 m alt., south of Frías, in a thicket of shrubs and herbs, 1 May 1980, C. *Ochoa 13938* (CIP, MOL, OCH, US, USM). Above Poclus Alto, *ca.* 3100 m alt., growing with *Alonsoa*, *Salvia*, *Verbena* and various composites and grasses, 2 May 1980, C. *Ochoa 13947*, 2n=24 (CIP, GH, MO, MOL, OCH, US, USM) and (CIP, MOL, OCH, USM,

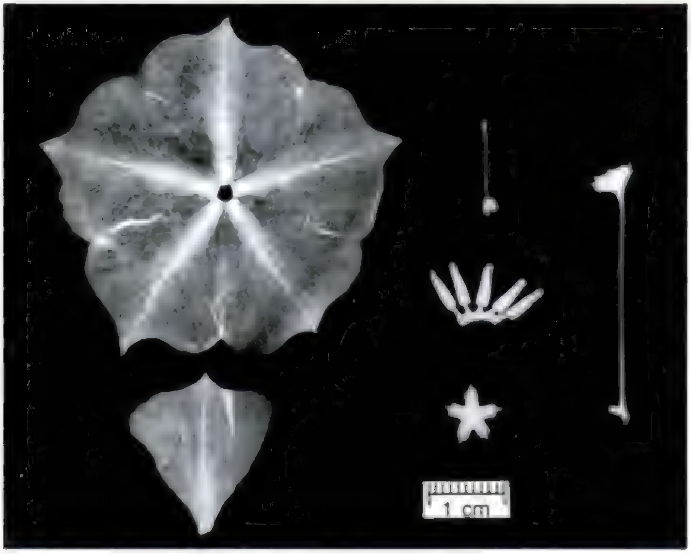


Figure 118. Floral dissection of *Solanum raquialatum* (*Ochoa 13947*).

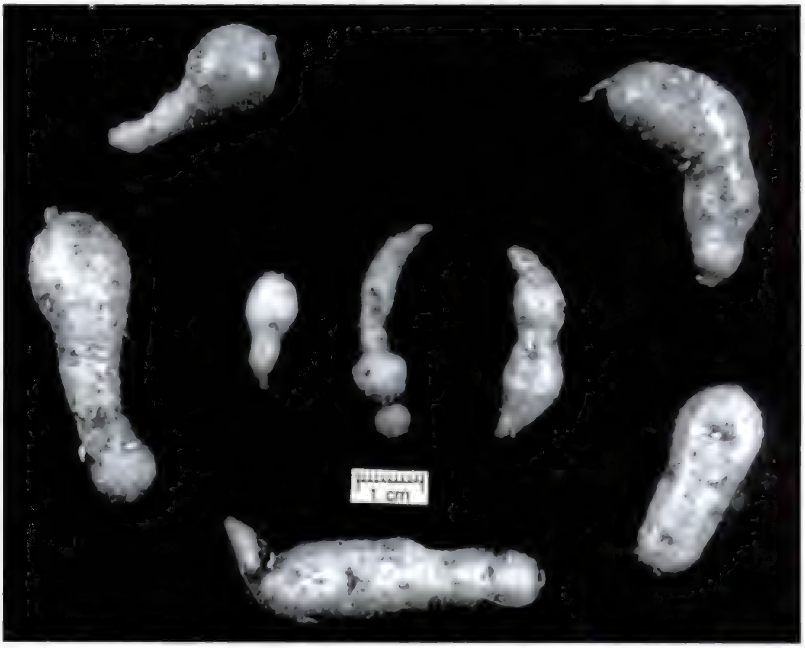


Figure 119. Tubers of *Solanum raquialatum* (*Ochoa 13937*).

from plants grown in the greenhouse at Huancayo). Between Frías and Comuna, 2400 m alt., 2 May 1980, *C. Ochoa 13949* (CIP, MO, MOL, GH, OCH, US, USM). Near Maray, on the road to Frías, 2600 m alt., in a shrub thicket, 5 May 1980, *C. Ochoa 13950* (CIP, GH, MO, MOL, OCH, US, USM). Churillo, 2800 m alt., on the lower slopes of Cerro Mijal, near the border of the Provinces of Morropón and Ayabaca, 6 May 1980, *C. Ochoa 13951*, 2n=24 (CIP, MOL, OCH, US, USM). Near Palo Alto, *ca.* 2950 m alt., 6 May 1980, *C. Ochoa 13957*, 2n=24 (CIP, GH, MOL, OCH, USM).

Province Huancabamba: Quebrada west of Canchaque, 1200 m alt., common in weedy growths, clay, annual herb 0.8 m tall, corolla white, stamens yellow, stems tend to be purplish in the better lighted situations, 4 April 1939, *H. E. Stork 11394* (UC-658015, G, GH, NA, isotypes of *S. raquialatum*). Lower foothills of Cerro Mishihuaca, 1900 m alt., amid dense scrub, n.v. *Papa de Wisco*, 13 May 1960, *C. Ochoa 2312* (OCH). Above Canchaque, 2300 m alt., in scrub near talus slopes of the Canchaque-Huancabamba road, 3 April 1964, *C. Ochoa and J.G. Hawkes 2574* (MOL, OCH). Cerro Mishihuaca, 2200 m alt., in a shrub thicket, on very moist organic soils, 7 May 1980, *C. Ochoa 13958*, 2n=24 (CIP, MOL, OCH, US, USM). Peña Huando, 2200 m alt., lower foothills of Cerro Huando, near Canchaque along the route of Canchaque-Paso Cuello del Indio and Huancabamba, 25 May 1982, *C. Ochoa 14823*, 2n=24 (CIP, MOL, OCH, USM).

Province Morropón: Cerro Moleján, 2000 m alt., in the La Cruz sector, community of Simiris, between Frías and Santo Domingo, Distr. Santo Domingo, 2 April 1991, *M.A. Delgado 001* (OCH). Guayacán, 1350 m alt., following the pedestrian road from Guayacán toward La Cruz, heading down from Santo Domingo toward San Jorge, community of Simiris, Distr. Santo Domingo, 3 April 1991, *M.A. Delgado 003* (OCH).

Table 27. Fertility of *Solanum raquialatum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	INGAEFOLIA	× *S. ingaefolium*	31(57)	16(21)	23(45)
24	1	OLMOSIANA	× *S. olmosense*	66(50)	8(5)	67(4)
24	1	SIMPLICISSIMA	× *S. guzmanguense*	16(11)	0(0)	0(0)
24	1	TUBEROSA	× *S. minutifoliolum*	8	0	0
24	2	CONICIBACCATA	× *S. chilliasense*	12(10)	0(6)	0(117)

			× *S. chomatophilum*	89(73)	45(18)	42(35)
			× *S. neovavilovii*	5	4	292
			× *S. suffrutescens*	22(17)	0(0)	0(0)
24	2	INGAEFOLIA	× *S. jalcae*	28(44)	22(27)	181(73)
24	2	PIURANA	× *S. albornozii*	3(7)	0(6)	0(42)
			× *S. chiquidenum*	20	12	2
			× *S. paucissectum*	6(16)	0(0)	0(0)
			× *S. piurae*	6(14)	0(3)	0(5)
24	2	TUBEROSA	× *S. bukasovii*	3(6)	3(4)	0(3)
			× *S. candolleanum*	2(3)	1(1)	0(10)
48	2	ACAULIA	× *S. acaule*	2	2	0
48	2	PIURANA	× *S. tuquerrense*	9(17)	6(9)	0(9)
48	4	TUBEROSA	× *S. tuberosum* subsp. *andigena*	19	5	0

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

The results of crosses of *S. raquialatum* with diploid (2n=24) species of EBN=1 and EBN=2 and tetraploid (2n=48) species of EBN=2 and EBN=4 are given in Table 26, while the materials used in these experiments are shown in Table 27.

Of special interest is the degree of success that was obtained in crosses between the three species that comprise the present series Ingaefolium, *S. raquialatum*, *S. ingaefolium* and *S. jalcae*. The ease of crossing of these species, of course, is suggestive of their close relationship.

Another surprising result concerned the crossing of the northern Peruvian species *S. ingaefolium* with the Bolivian species *S. neovavilovii* of the series Conicibaccata. Even though these species belong to entirely different series and even though only a few flowers were pollinated, this cross yielded a high average number of seeds per berry.

When used as a mother plant, *S. raquialatum* crosses easily with two other species of series Ingaefolia, *S. jalcae* and *S. ingaefolium*. F_1 plants of the cross *S. raquialatum* (*13958*) × *S. ingaefolium* (*11614*) are extremely vigorous, more than 1 m tall, and have thick stems and some of the dominant leaf characteristics of *S. raquialatum* (*e.g.*, leaves with up to 6 pairs of lateral leaflets and 6-7 pairs of interjected leaflets). However, such plants differ from *S. raquialatum* in having very narrowly winged leaf rachises, pedicels up to 40 mm long that are articulated about 6 mm below the calyx, and small purple corollas that are usually no more than about 2.5 cm in diameter.

The cross between *S. raquialatum* (*13958*) and *S. jalcae* (*14490*) yields plants with slender stems that are up to 1 m tall, leaves having 4-5 pairs of elliptic-lanceolate leaflets and 3-4 pairs of interjected leaflets on a narrowly winged rachis, 15-20 m long pedicels that are articulated 5-6 mm below the calyx, calyces with narrow lobes and long-pointed or subspathulate 5-6 mm long acumens, and small, lilac corollas that are about 2.5 cm in diameter. These hybrids are very showy. As each individual produces a large number of inflorescences that bear numerous flowers, the plants of this cross might conceivably be used as ornamentals. More or less similar results were obtained in crosses between *S. raquialatum* (*13958*) and OCH collections *13344*, *14488* and *14782* of *S. jalcae*. However, while these last series of crosses were easily obtained, the resultant F_1 plants varied markedly in stem pigmentation, corolla color and in certain rachis characteristics.

The cross between *S. raquialatum* (*13951*) and *S. olmosense* (*13348*) resulted in vigorous individuals having thick, triangular stems up to 1.2 m tall, leaves resembling *S. raquialatum* but more narrowly winged, pedicels articulated in the upper one-third of their length, small, white, substellate corollas no more than 2.5 cm in diameter and small, round, purple tubers about 2 cm long.

As in the above crosses, little difficulty was realized in achieving crosses between *S. raquialatum* and certain species of series Conicibaccata, such as *S. chomatophilum* and *S. neovavilovii*.

The cross between *S. raquialatum* (*13958*) and *S. chomatophilum* (*14787*) yielded plants 60-70 cm tall with slender stems 5-7 mm in diameter, but having the stems very branched and erect-decumbent. The hybrid populations, in this case, greatly resembled *S. chomatophilum* in leaf shape and dissection and in the size and color of the corolla.

Lastly, the cross between *S. raquialatum* (*133958*) and *S. neovavilovii* (*14993*) resulted in plants up to 70 cm tall having graceful stems and some dominant features of *S. neovavilovii*, including the characteristic habit of the plant, shape and dissection of the leaves, point of articulation of the pedicels and the size and color of the corolla, but differing in having paniculate inflorescences and long-conical fruits. The peduncle, on the other hand, is short while the calyx is small. As in *S. raquialatum*, the hybrids have acuminate lobes and pointed, filiform acumens up to 2 mm long.

Table 28. Collections (OCH) used in *Solanum raquialatum* fertility studies.

ACAULIA
S. acaule 13623

CONICIBACCATA
S. chilliasense 13350
S. chomatophilum 11061, 13205, 13206, 13208, 13212, 13307, 13325, 13332, 13341, 13343, 14485, 14487
S. neovavilovii 14993
S. suffrutescens 13371

INGAEFOLIA
S. ingaefolium 11614, 13952
S. jalcae 13344, 14488, 14490, 14782
S. raquialatum 13937, 13947, 13950 13951, 13957, 13958, 14823

OLMOSENSA
S. olmosense 13348

PIURANA
S. albornozii 11007
S. chiquidenum 11965A, 11972
S. paucissectum 11634
S. piurae 13959, 13960
S. tuquerrense 13400

SIMPLICISSIMA
S. guzmanguense 15991

TUBEROSA
S. bukasovii 7820, 13694
S. candolleanum 15012, 15015
S. chillonanum 13350
S. minutifoliolum 13390
S. tuberosum subsp. *andigena* 14225

SERIES LIGNICAULIA

LIGNICAULIA S.M. Bukasov & L.E. Gorbatenko, in Sborn. Nauch. Tr. Prikl. Bot. Genet. Selek. 126:104. 9 August 1989; J.G. Hawkes in Taxon 38(3):489-492, 29 August 1989.

This monotypic series, as represented by its type species *S. lignicaule*, is characterized by the following features: Plants glandular; Stem woody and cylindrical, densely velvety pubescent; Corolla substellate, yellowish-white; Fruit round to ovoid. This species offers valuable resistance sources to Bacterial wilt or *Pseudomonas solanacearon* (CIP Annual Report 1997, p. 46), potato cyst nematode or *Globodera pellida* (CIP Annual Report 1981, p. 37), green peach aphid or *Myzus persicae,* and potato tuber moth or *Phytorimaca operculella* (CIP Annual Report 1992, p. 83)

Distribution

Restricted to the Provinces of Calca, Paruro and Urubamba of the Department of Cusco in southern Peru.

26. *Solanum lignicaule* Vargas, Rev. Argentina Agron. 10:398, 1943; *Las Papas Sudperuanas*, Univ. Nac. Cusco 1:89-90, illustr., 1949.

Figs. 120-126; Map 27; Plate XII.

S. vargasii Hawkes, Bull. Imp. Bur. Pl. Breed. & Genet., Cambridge, 12,13, 113, illustr., 1944 (without type citation).

S. lignicaule var. *longistylum* Vargas, *Las Papas Sudperuanas*, Univ. Nac. Cusco 2:56, illustr., 1956. type: Peru, Dept. Cusco, Prov. Urubamba, above Tarapata, 3150 m alt., in calcareous-clay soil, Feb. 1951, *C. Vargas C. 10051* (CUZ).

Plant erect or erect-ascending 30-50(-60) cm tall, densely glandular-puberulent or glandular-pilose on all its parts. Stem cylindrical, woody, wingless, generally simple, somewhat flexed, 4-7 mm in dia. at base; hairs simple, unequally long, mixed with short, dense, glandular tetralobular hairs; internodes (1.5-)3.5-5.0 cm long. Plant stoloniferous and tuber-bearing, stolons 25-30(-50) cm long, slender, 1.5-2.0 mm in dia., white; tubers globose to oval-flattened, small, 1.5-3.0 (-5.0) cm long, white. Leaves imparipinnate (7-)11-17 cm long by (4.0-)5.5-14.0 cm broad, yellowish-green above, gray-green or whitish-gray below, with 2-3(-4) pairs of leaflets, with or without a few interjected leaflets; leaflets narrowly elliptic-lanceolate or lanceolate, shortly petiolulate to sessile, the apex subobtuse or pointed to attenuate-acuminate and the base cuneate to obliquely rounded; terminal leaflet slightly larger than the first pair of lateral leaflets, (5.0-)6.0-8.5 cm long by (1.0-)1.5-2.5 cm broad, the second and subsequent pairs of leaflets much smaller than the first pair. Pseudostipular leaves falcate, 6-12 mm long by 2.5-5.0 mm broad. Inflorescence cymose, 4-10-flowered, densely puberulent. Peduncle short, 2-4(-6) cm long; pedicels pubescent, short, 10-15(-20) mm long; articulated near or above the midpoint, or 5-6 mm below the base of the calyx. Calyx densely pubescent and glandular, symmetrical or asymmetrical, 7-9 mm long, lobes broadly subquadrate, abruptly narrowed to long-spatulate, 4-5 mm long acumens. Corolla broadly substellate, 2.5-3.0 cm in dia. with prominent acumens (Fig. 122), pure yellowish-white or occasionally yellowish-white with light-purplish acumens and upper petal lobes. Anthers oblong-lanceolate, 4.5-5.5(-6.5) mm long, orange-yellow, base cordate; filaments about 1.5 mm long, white-hyaline, glabrous. Style 8-9 mm long, densely papillose along the basal one-third of its length; stigma claviform, cleft. Fruit ovoid, 1.5 cm long, dark green, densely flecked with small white dots, not verrucose (Fig. 123). Chromosome Number: 2n=24. EBN=1.

Local Name: *Atokk Papa* (=*Papa de Zorro* or Fox Potato).

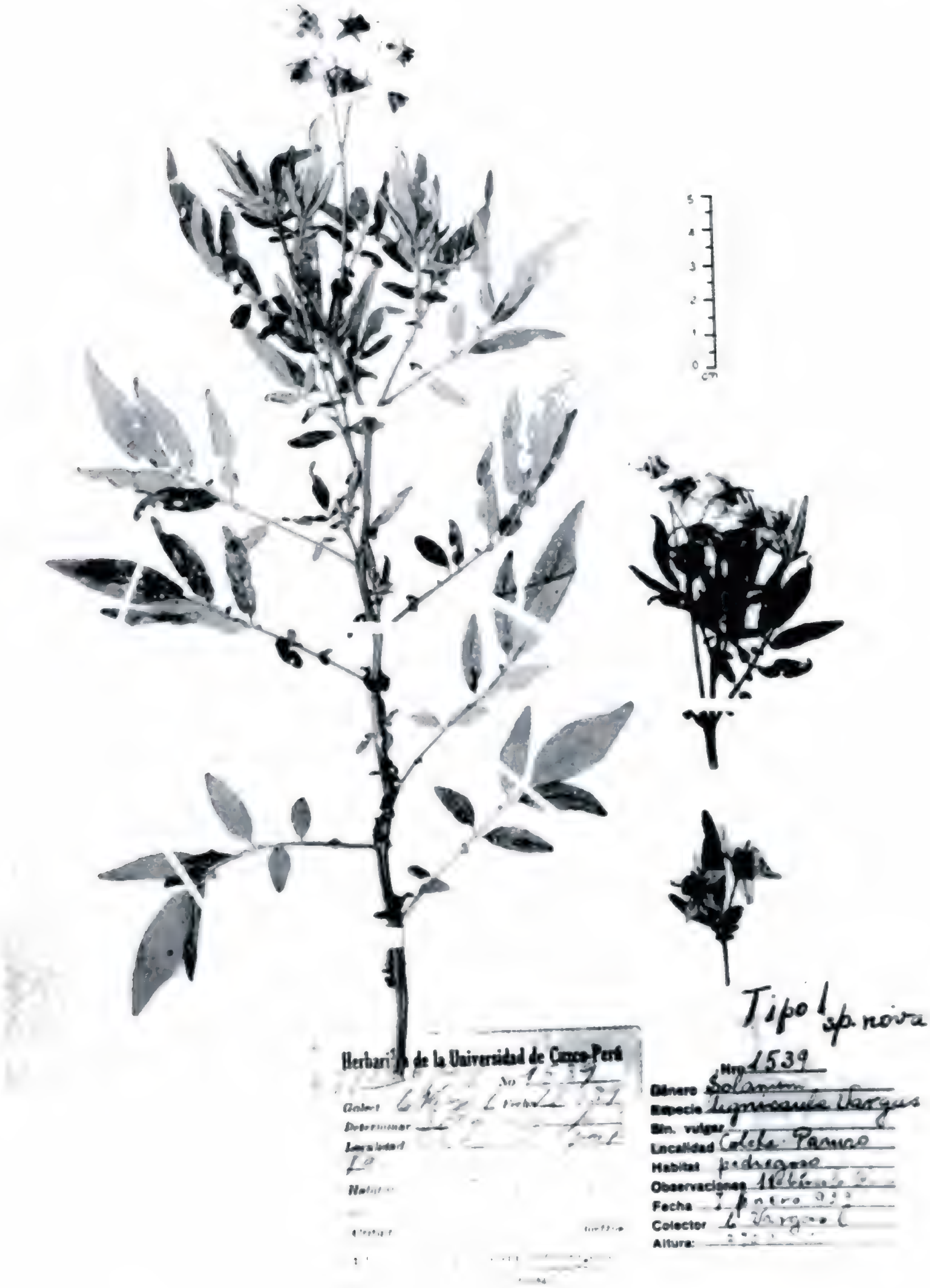


Figure 120. *Solanum lignicaule* (*C. Vargas C. 1539*, lectotype).

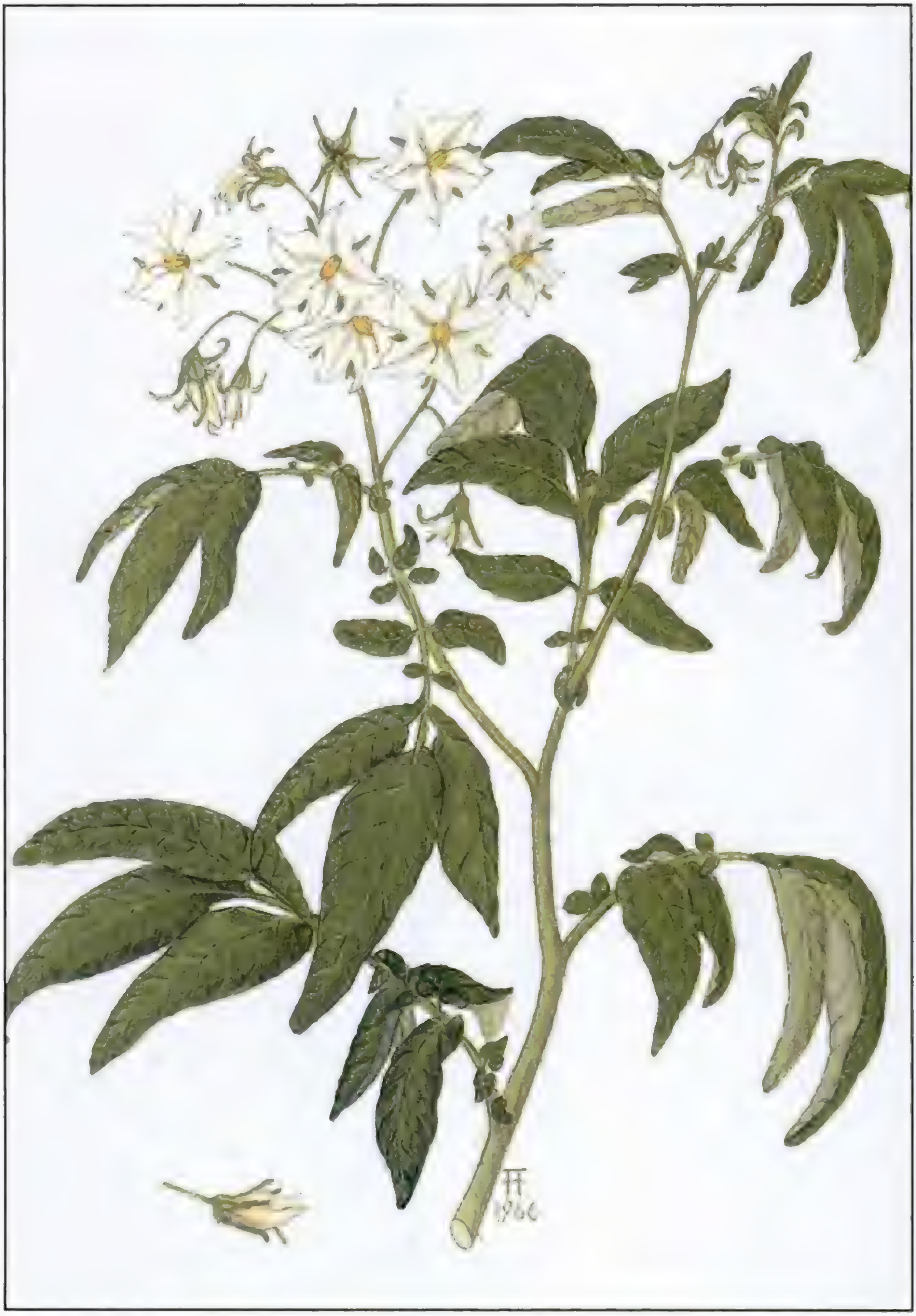


Plate XII. *Solanum lignicaule* Vargas.

Type: PERU. Department Cusco, Province Paruro, Colcha, Quetepampa, 2750 m alt., in a rocky habitat, tubers white, 7 January 1939, *C. Vargas C. 1539* (holotype CUZ, designated here; isotypes F, G, GH, K, LL, UC distributed by Goodspeed under his Accession No. *9730*).

The name of this series, Lignicaulia, was first proposed by Bukasov in 1980. His classification includes this series within a larger grouping of series that contains all diploid Andean species that have a pentagonal corolla. However, Bukasov's name for this series was not validly published following the standards of Article 36.1 of the International Code of Botanical Nomenclature.

According to the CD-ROM version of the Kew Index, the correct citation for this series should read, "*Solanum* ser. Lignicaulia Buk. & L.E. Gorbatenko, *in* Sborn. Nauch. Tr. Prikl. Bot. Genet. Selek. 126:104, 9 August 1989." However, only a short time afterwards Hawkes published the same name for this series, Lignicaulia, in Taxon 38:490, 29 August 1989, thereby creating an *isonym*. Priority, in this case, is established by Articles 29 and 30 of the International Code (Tokyo, 1994).

Because of the densely pilose glandular-puberulent nature of the indumentum of *S. lignicaule*, this species could be valuable to the plant breeder as a major genetic source of resistance to insects, and especially aphids, which the author has never observed to be particularly troublesome to these plants in their natural habitats. This species is known to be resistant to the attacks of various species of *Epitrix*, *Empoasca* and *Ligus*, as well as to the ravages of the Colorado Potato Beetle, or *Leptinotarsa decemlineata* (Bamberg, 1994). It is also resistant to *Fusarium* and *Verticillium* (two genera responsible for wilt disease), *Erwinia carotovora* (black-leg disease), *Corynebacterium sepedonicum* (an organism causing annular decay of the tubers) and *Synchytrium endobioticum* (or wart disease).

Affinities

The white color of the corolla of *S. lignicaule* suggests that it is distantly related to *S. yungasense*. However, the shape of the corolla, leaves and calyces of the two species differ radically from one another. Moreover, *S. yungasense* has a strongly winged, fleshy and somewhat succulent stem, while that of *S. lignicaule* is woody, wingless and cylindrical.

Habitat and Distribution

This species has been collected from stone piles, trail margins and rocky slopes and *andenes* (ancient agricultural terraces). It is frequently found growing in

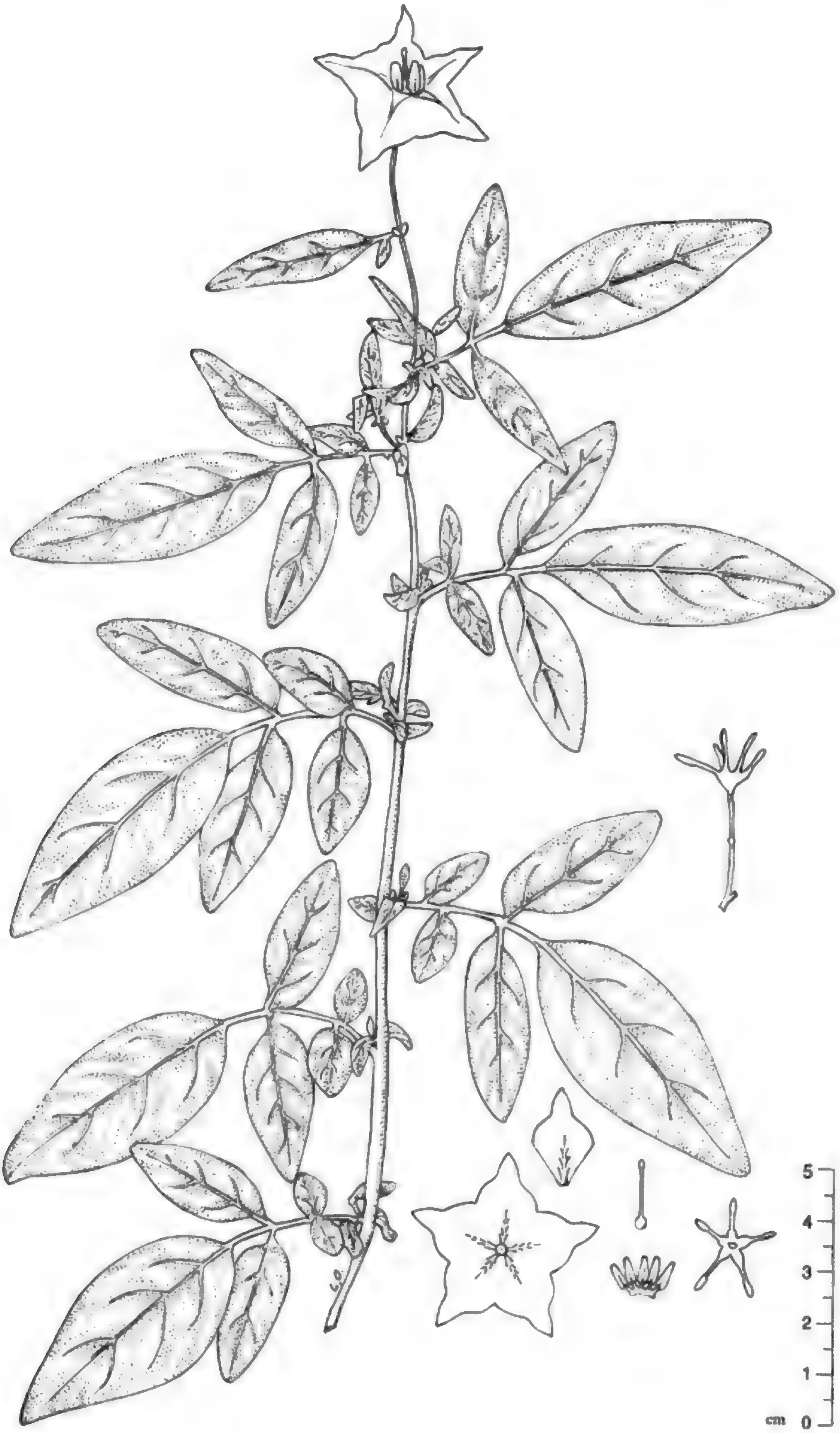


Figure 121. *Solanum lignicaule* (*Ochoa 13760*).

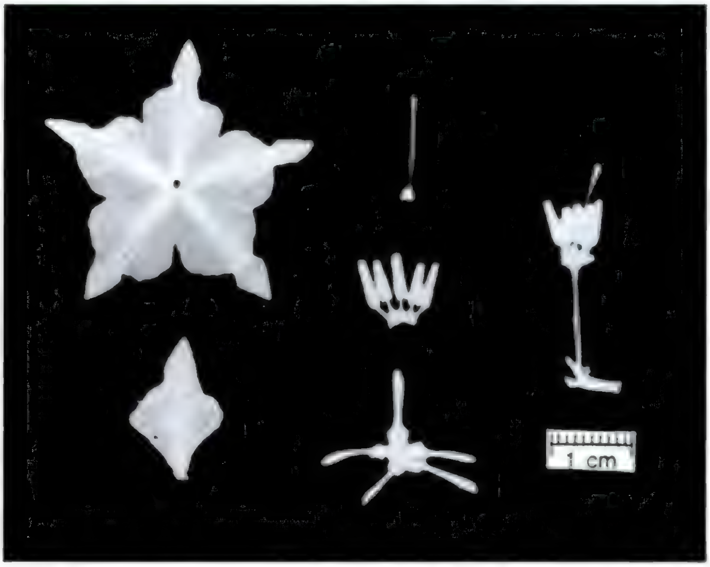


Figure 122. Floral dissection of *Solanum lignicaule* (*Ochoa 11317*).

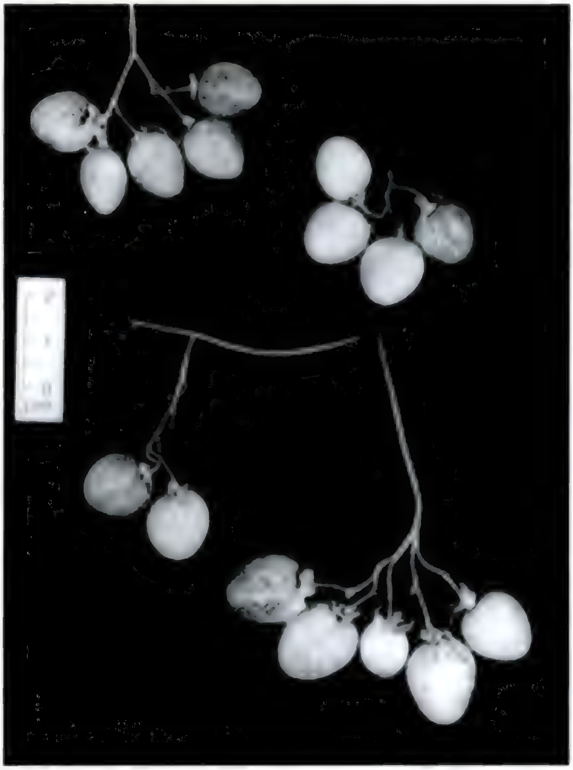


Figure 123. Berries of *Solanum lignicaule* (*Ochoa 11317*).

sandy-clay soils in dry or subxerophytic environments, where it may be associated with various members of the cactus family, including *Corryocactus* sp., *Erdisia squarrosa*, *Opuntia exaltata* and *Trichocereus* sp., a species of the bromeliad genus *Pitcairnia*, shrub plants such as Nicotiana glauca and *Eupatorium* sp., or a single tree species, *Schinus molle* (Figs. 124 and 125). It has also been collected from the same habitats as *S. raphanifolium* and *S. marinasense*, two tuber-bearing species belonging, respectively, to the series Megistacroloba and Tuberosa.

With respect to its geographic distribution, *S. lignicaule* is presently known only from the following five places in southern Peru, all located within the Department of Cusco: Vicinity of Pisac and the Royal Palace of Intihuatana (the latter at 3400 m; see Fig. 126); Rocky slopes rising above the ruins of Pisac towards Ampay and Kkolkkepata (3200 m alt.); Anco Cunca, a xerophytic canyon (*ca.* 2975 m alt.); and, Vicinity of Colcha (2750 m alt.); and, in Tarapaca, close to Urubamba (Map 27).

Specimens Examined

Department Cusco

Province Calca: Ruins of Pisac, 3800 m alt., n.v. *Atokk Papa*, 9 January 1938, *H.L. Blood and L. Tremelling 175* (NA). Pisac, 3200 m alt., on stony hillsides and calcareous outcrops, February 1944, *F. Marín 111* (F). Ruins of Intihuatana, Pisac, 3400 m alt., on stony hillsides, 1-2 white oval-flattened tubers, 20 March 1945, *C. Vargas C. 5070* (CUZ, LL, OCH). Heading up from Pisac to the ruins of Intihuatana, above the Inca terraces, 3000 m alt., n.v. *Ñaupa Papa*, 24 April 1953, *C. Ochoa 2060* (LL, OCH). On rocky slopes on mountains above Pisac, 3050 m alt., 27 February 1958, *D.S. Correll, E.E. Smith and C. Vargas C. P227* (LL, two sheets). Terraces of Pisac, 3400 m alt., 16 February 1960, *C. Ochoa 2187* (MO, MOL, OCH, USM). 4.5 km from Pisac on road to Calca, 2900 m alt., on and between rocky ledges of road cut, tubers in small earth pocket between stone ledges, many tubers growing in chain-like fashion along a single stolon, flowers cream-colored, 22 February 1963, *D. and V. Ugent 3875-7* (WIS), *3886* (GH), *3887-8* (WIS), *3889*, sheet-1 (WIS), *3890-91* (OCH), *3892-6* (WIS), *3897* (WIS), *3898* (F), *3899* (WIS), *3905-6* (WIS), *3909*, sheet-1 (WIS), *3909*, sheet- 3 (WIS), *3909*- sheet-4 (OCH). On rocky slopes above Pisac, 3000 m alt , 20 April 1964, *J. G. Hawkes 2482* (Sturgeon Bay, Wis., USA, *PI-310993*) (OCH). On terraces below ruins, 3200-3400 m alt., no flowers, 11 April 1971, *J.P. Hjerting, P.J. Cribb, and Z. Huamán 5113* (CIP). Ampay, 3200 m alt., above Pisac, on the road to Kkolkkepata, March 1977, *C. Ochoa 11315*, 2n=24 (MOL, OCH, USM). Ampay, 3200 m alt., heading up the road from Pisac toward Kkolkkepata, March 1977, *C. Ochoa 11316*, 2n=24 (CIP, MO,

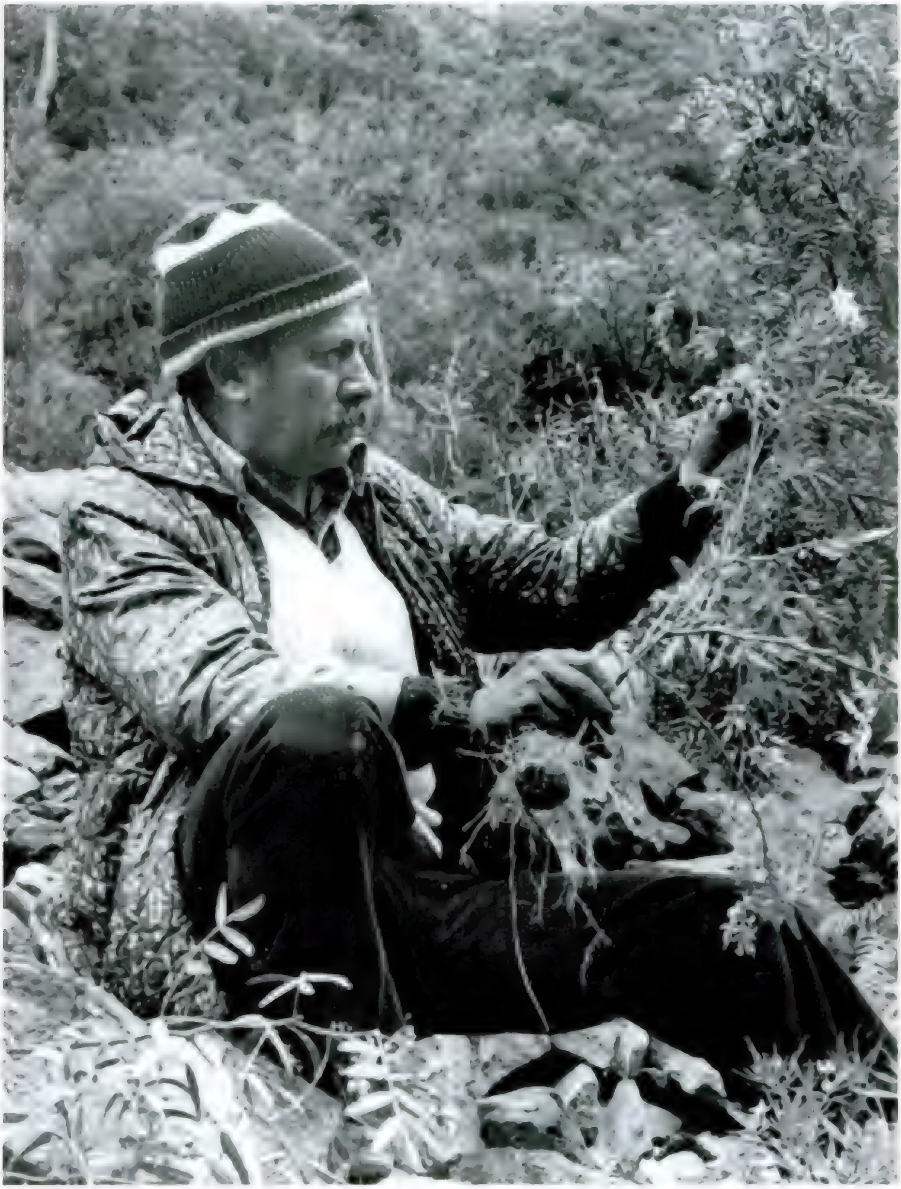


Figure 124. Carlos Ochoa examining *Solanum lignicaule* in its native habitat between Colcha and Paruro, Cusco, March 1980.

material

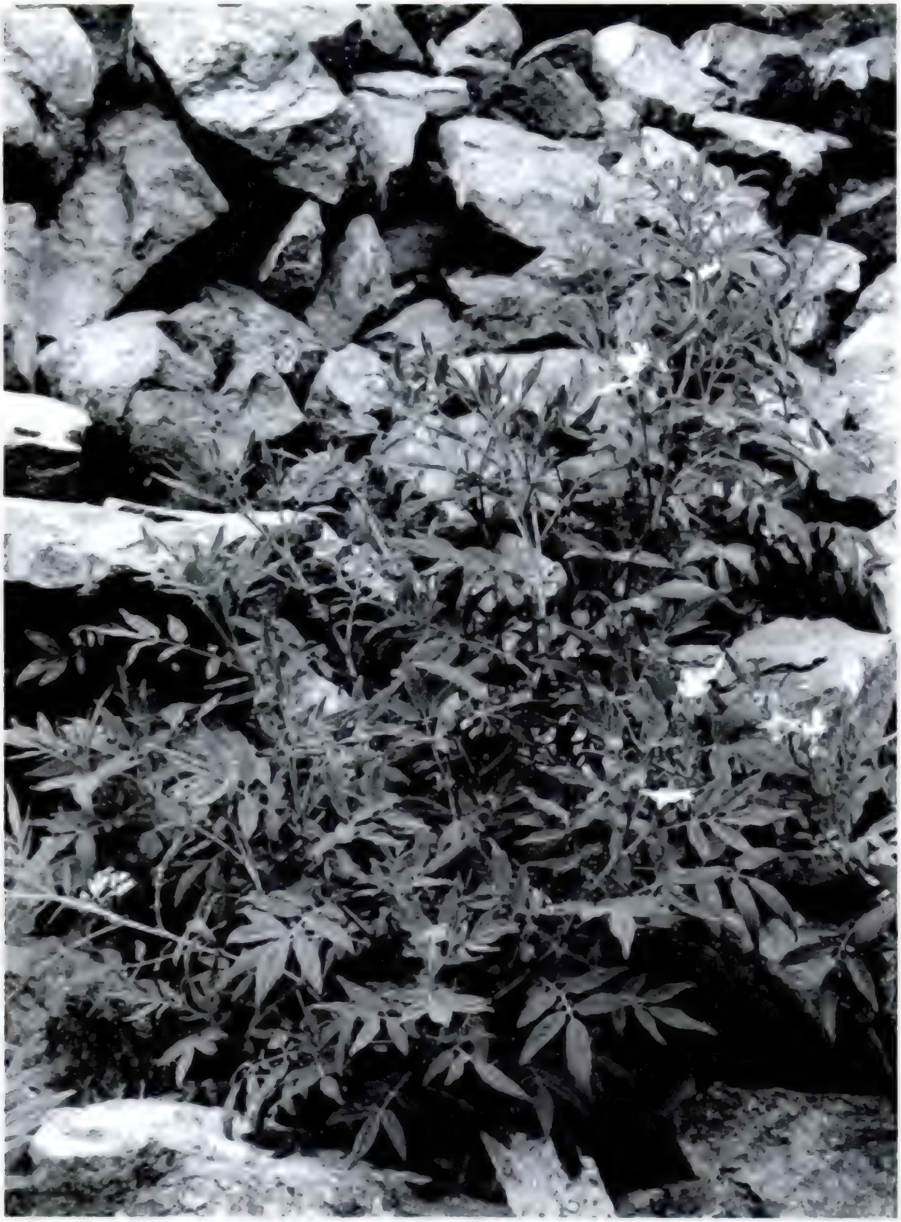


Figure 125. Habitat of *Solanum lignicaule* Vargas at a locality situated between Colcha and Paruro, Cusco.

MOL, OCH, USM), and *11317* (CIP, OCH). Near Intihuatana, Pisac, 2950 m alt., amid *Pitcairnia* sp. and *Erdisia squarrosa*, 10 April 1977, *C. Ochoa 11617*, 2n=24 (CIP, OCH). East side of the Royal Palace Intihuatana, 3300 m alt., (Pisac), 16 March 1980, *C. Ochoa 13760*, 2n=24 (OCH).

Province Paruro: Colcha, Quetepampa, 2750 m alt., stony habitat, tubers white, 7 January 1939, *C. Vargas C. 1539* (CUZ, F, G, GH, K, LL, UC, type collection of *S. lignicaule*, distributed by Goodspeed under his Accession No. *9730*). On the stony xerophytic hillsides of Canyon Anco Cunca, 2975 m alt., near Cusibamba, between Paruro and Colcha, in a subxerophytic region, associated with *Opuntia exaltata* and *Trichocereus* cacti, shrubs such as *Nicotiana glauca* and *Eupatorium* sp., *Shinus molle* trees and some non tuber-bearing *Solanums*, tubers up to 6 cm long, ovoid to oval-flattened, 1 February 1980, *C. Ochoa 13584* (CIP, MOL, OCH) and *13585*, 2n=24 (CIP, MOL, OCH, USM).

Table 29. Fertility of *Solanum lignicaule* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

EBN	2n	Series	Species	FL	TB	SB
24	1	MEGISTACROLOBUM	× *S. dolichocremastrum*	2(6)	2(5)	29(70)
24	1	PIURANA	× *S. hypacrarthrum*	2(5)	0(5)	0(33)
24	1	TUBEROSA	× *S. chancayense*	5(7)	0(7)	0(46)
			× *S. mochiquense*	4(14)	3(12)	11(33)
24	2	CONICIBACCATA	× *S. chomatophilum*	6(25)	0(16)	0(47)
			× *S. laxissimum*	3	0	0
			× *S. limbaniense*	9(14)	0(14)	0(0)
24	2	CUNEOALATA	× *S. peloquinianum*	5	5	80
24	2	MEGISTACROLOBA	× *S. raphanifolium*	9(10)	0(5)	0(5)
24	2	TUBEROSA	× *S. bukasovii*	35(27)	20(18)	0(83)
			× *S. coelestispetalum*	4	1	0
			× *S. goniocalyx*	8(16)	1(5)	0(55)
			× *S. leptophyes*	5	1	0
			× *S. marinasense*	5(10)	1(3)	0(17)
			× *S. multiinterruptum*	10	9	22
			× *S. phureja*	4	0	0
			× *S. saxatilis*	3	0	0
			× *S. velardeii*	4	1	0

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

The results of crosses of *S. lignicaule* with diploid (2n=24) species of EBN=1 and EBN=2 are given in Table 29, while the materials used in these experiments are shown in Table 30.

Considering the usual difficulties involved in crossing the cultivated *S. goniocalyx* with the wild species of this section, it is interesting to note that the crosses of *S. lignicaule* with *S. goniocalyx* yielded an exceptionally high average number of seeds per berry when the latter species was used as the pistillate parent.

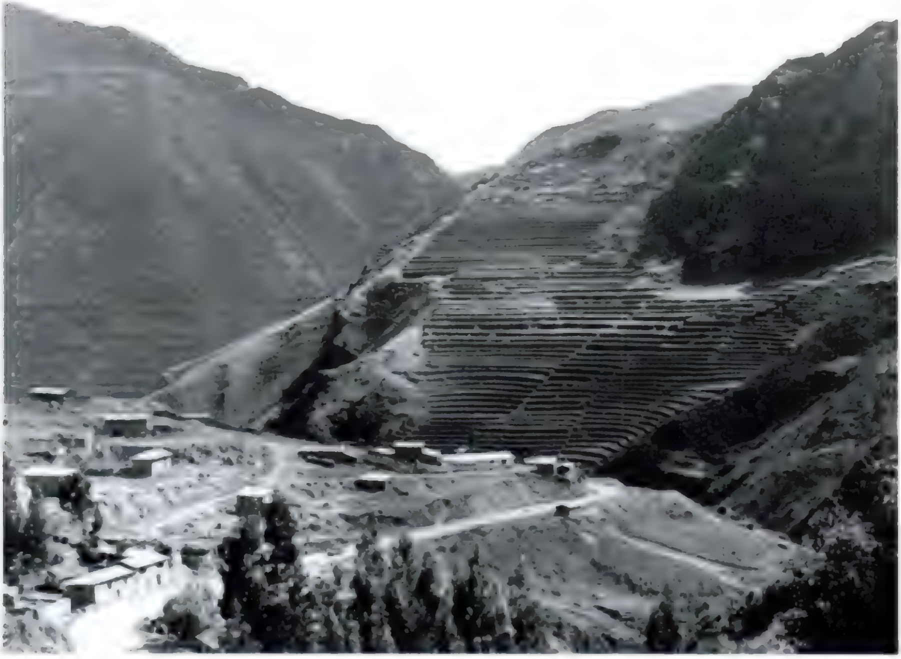


Figure 126. Terraces at Pisac on the eastern side of the road from Pisac to Ampay, comprising the semi-natural habitats of *Solanum lignicaule*, *S. raphanifolium* and *S. marinasense*.

Table 30. Collections (OCH) used in *Solanum lignicaule* fertility studies.

CONICIBACCATA	
S. chomatophilum	13205, 13207, 13210, 13325
S. laxissimum	11855
S. limbaniense	14288
CUNEOALATA	
S. peloquinianum	13230
LIGNICAULIA	
S. lignicaule	11315, 11316, 11317, 11617 13584, 13585, 13760, 14416
MEGISTACROLOBA	
S. dolichocremastrum	12074
S. raphanifolium	7610, 7619, 13610
PIURANA	
S. hypacrarthrum	13272
TUBEROSA	
S. bukasovii	11851, 11859, 11876, 13121 13195, 13559, 13599, 13707, 14333, 14407
S. chancayense	11250
S. coelestispetalum	7710
S. goniocalyx	00001
S. leptophyes	13671
S. marinasense	13592, 13619, 13749A
S. mochiquense	14870
S. multiinterruptum	12055
S. phureja	15141
S. saxatilis	15082

SERIES MEGISTACROLOBA

MEGISTACROLOBA Card. et Hawkes, J. Linn. Soc., Bot. 53:93, 1946.

Plants herbaceous, stoloniferous and tuber-bearing, usually small, stems short or abbreviated to rosette-forming, rarely long or extended. Leaves imparipinnatisect or occasionally imparipinnate, rarely simple.Terminal leaflet conspicuously larger than the laterals; lateral leaflets, when present, very small, basiscopically broadly decurrent about the rachis. Peduncle usually very short; pedicel long, conspicuously articulated about 4-10 mm below the calyx. Corolla rotate to rotate-pentagonal or pentagonal-substellate, purple or lilac. Fruit round or broadly ovoid.

Distribution

The various species of this series are distributed from the Andes of northern Peru to Bolivia and the mountains of northwest Argentina. The series is represented in Peru by *S. sogarandinum*, *S. hastiforme*, *S. dolichocremastrum*, *S. raphanifolium* and *S. megistacrolobum*; in Bolivia by *S. boliviense* and the wide-ranging *S. megistacrolobum* (this also extending into Argentina); and, in Argentina, by *S. sancta-rosae* and two hybrids, *S.* × *brucheri* and *S.* × *indunii*. As evident from the above, the greater part of the diversity of this series falls in Peru.

The series Megistacroloba contains certain species that have great potential value for plant improvement purposes. For example, *S. raphanifolium* and *S. sogarandinum* are resistant to the attack of early blight (*Alternaria solani*), wart disease (*Synchytrium endobioticum*) and verticilosis (*Verticillium* sp.) (Bamberg et al., 1994a). Various accessions of these species have also shown some resistance to bacterial wilt (*Pseudomonas solanacearum*) (CIP Inf. Anual 1977, p. 46; 1978, p. 22; 1986-1987, p. 77-78), black leg (*Erwinia carotovora*) and ring rot

(*Clavibacter michiganensis* subsp. *sepedonicus* = *Corynebacterium sepedonicum*) (Kurowski and Manzer, 1990). Other collections of these two species have also shown some resistance to the leafroll virus (PLRV) (Bamberg et al., 1994a), the Colorado potato beetle (*Leptinotarsa decemlineata*), aphids, and frost. *S. megistacrolobum* presents some resistance to the aphid *Myzus persicae* and to the potato tuber moths or *Phthorimaea operculella* (CIP Inf. Anual 1992, p. 83). Moreover, *S. megistacrolobum*, *S. sogarandinum* and *S. raphanifolium* show an unusual amount of resistance to *Globodera pallida* (CIP Inf. Anual 1973, p. 42; 1979, p. 35; 1980, p. 40; 1981, p. 37). *S. sogarandinum* appears to do well in areas subject to abnormally high temperature. Finally, two species, *S. dolichocremastrum* and *S. megistacrolobum*, appear to do well in areas subject to sudden drops in temperature (CIP Inf. Anual 1973, p. 18; 1978, p. 8, 51).

KEY TO SERIES MEGISTACROLOBA

1. Plants normally rosette-like or subrosette-like, rarely erect-ascending; leaves with (0)1-3(-4) pairs of lateral leaflets; terminal leaflets much larger than the laterals.
    2. Lateral leaflets, when present, ovate to ovate-elliptic, much smaller than the terminals and more broadly decurrent; peduncle short, 1-4 cm long.
        3. Corolla rotate-pentagonal, purple or violet.
            4. Tubers small, 1-2 cm long, round to ovoid, white .... 29. *S. megistacrolobum*
            4. Tubers large, 3-4 cm long, long-subcylindric, purple .... 29b. *S. megistacrolobum* f. *purpureum*
        3. Corolla rotate, blue or bluish violet. .... 31. *S. sogarandinum*
    2. Lateral leaflets, when present, broadly ovate, much larger and much more broadly triangular-decurrent than the terminals; peduncle large, 7-9 cm; corolla rotate, violet or lilac .... 29a. *S. megistacrolobum* var. *toralapanum*
1. Plants usually erect-ascending or only rarely rosette-like; leaves with (0-)1-4(-5) pairs of lateral leaflets, ovate to obovate, sessile or somewhat decurrent; terminal leaflets slightly larger or much larger than the laterals.
    5. Corolla rotate-pentagonal, purple or violet; plant weakly erect; leaves with (0-)1-3 pairs of lateral leaflets, sessile, very narrowly decurrent, coarsely and sparsely pilose.

6. Terminal leaflet broadly ovate .... 30. *S. raphanifolium*
6. Terminal leaflet broadly rhombic to ovate-rhombic, the apex obtuse to subpointed and abruptly and shortly acuminate .... 27. *S. dolichocremastrum*
5. Corolla rotate; plant erect to erect-decumbent; leaves with 0-1(-2) pairs of lateral leaflets, sessile and narrowly decurrent at base, coarsely ... and densely pilose; terminal leaflet (or blade) ovate to elliptic or broadly elliptic, the apex pointed and subobtuse .... 28. *S. hastiforme*

27. *Solanum dolichocremastrum* Bitt., *emend.* Ochoa, Fedde Repert. Sp. Nov. 12:3-4, 1913. Figs. 127-132; Map 13.

S. chavinense Corr., Wrightia 2:185-186, 1961. Type: PERU. Department Ancash, [Province Huari], *D.S. Correll and E. Smith P973* (LL, US, USM).

S. huanucense Ochoa, *Los Solanum Tuberíferos Silvestres del Perú*, Lima, 190-193, 1962. Type: PERU. Department Huánuco, Province Dos de Mayo, *C. Ochoa 2378* (MOL, OCH, USM).

Plants (15-20-)30-50(-60-70) cm tall, more or less pilose on all of its parts. Stem weakly erect or slightly decumbent, pigmented dark brown to brownish violet, usually simple, slender, 2-3(-5) mm in diam. at base; internodes at base short, 2-3 cm long, elongating toward the middle of the stem and upper portion, where they may be 5-7 cm long; stem subglabrous or sparsely pilose along the basal one-third of its length and more densely pilose in the middle and upper sections; hairs thick, unequally long, 1-3 mm, silvery white or straw-colored. Plant stoloniferous and tuber-bearing; stolons fine and slender, 50-80 cm long, scarcely 1.5 mm in diam., white; tubers round to ovoid, 2-3 cm long or, rarely and unequally long, slender, and extremely obtuse or fusiform, 7-10 cm long by 1.5-2.0 cm thick (Fig. 132). Leaves dark green above and lighter green below, 5-8(-16-20) cm long by (2.5-)4.5-11.0(-14.0) cm wide, imparipinnate or very rarely with some simple leaves at base, little divided, with (0-)1-2(-3) pairs of lateral leaflets and no interjected leaflets; leaves pubescent on both sides including the margins of the leaflets; hairs short, sparse, adpressed, smaller and finer on the lower surface; glandular hairs sparse, tetralobular, distributed principally on the rachis, petioles and petiolules. Terminal leaflet much larger than the laterals, (2.5-3.5-)6.0-9.5(-11.5) cm long by (2.0-2.3-)4.0-5.0(-7.5) cm wide, broadly rhombic to ovate-rhombic, occasionally broadly elliptic to suborbicular, apex somewhat pointed to shortly acuminate, base cuneate, petiolule long-decurrent. Lateral leaflets

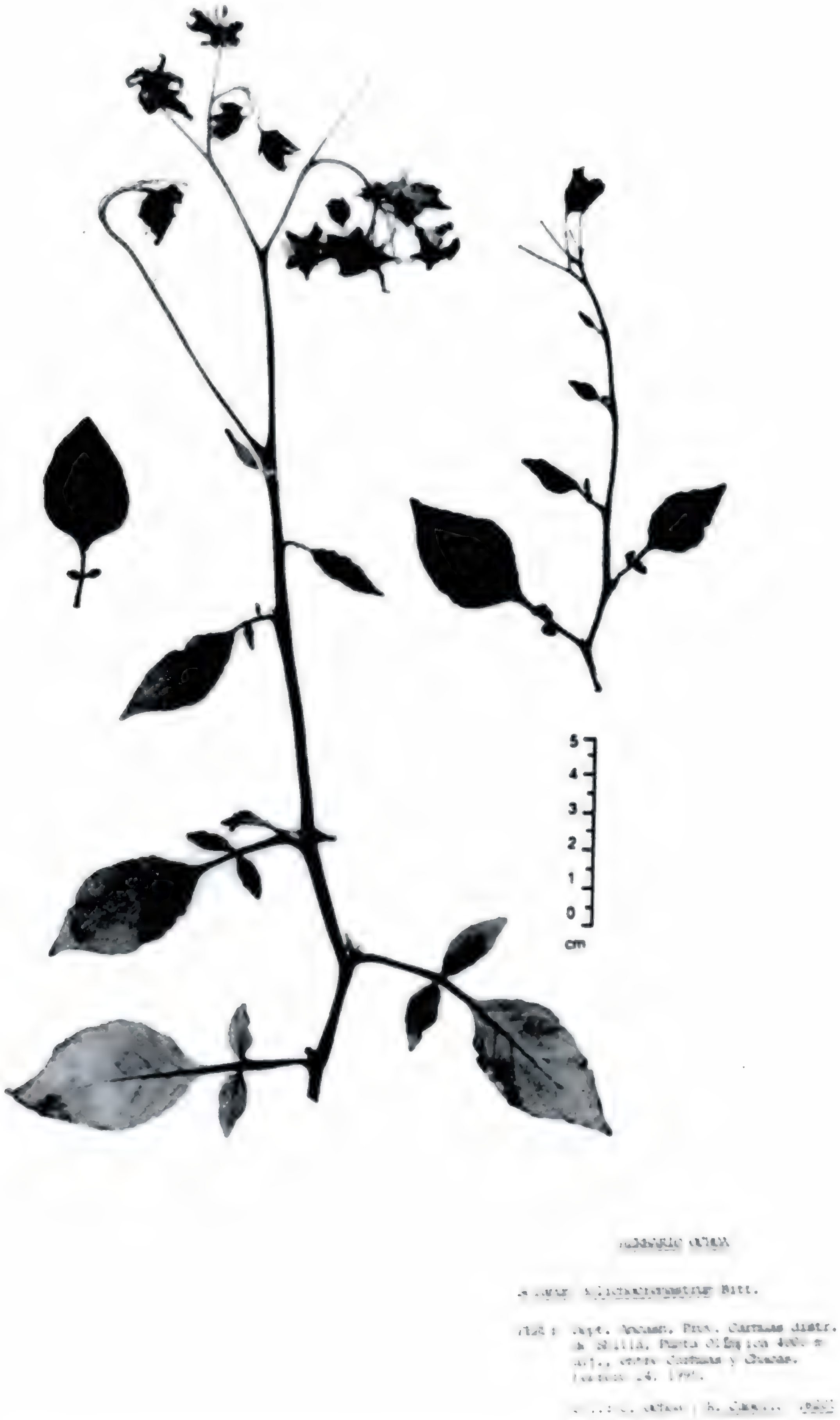


Figure 127. *Solanum dolichocremastrum* (*Ochoa and Cabello 16201*).

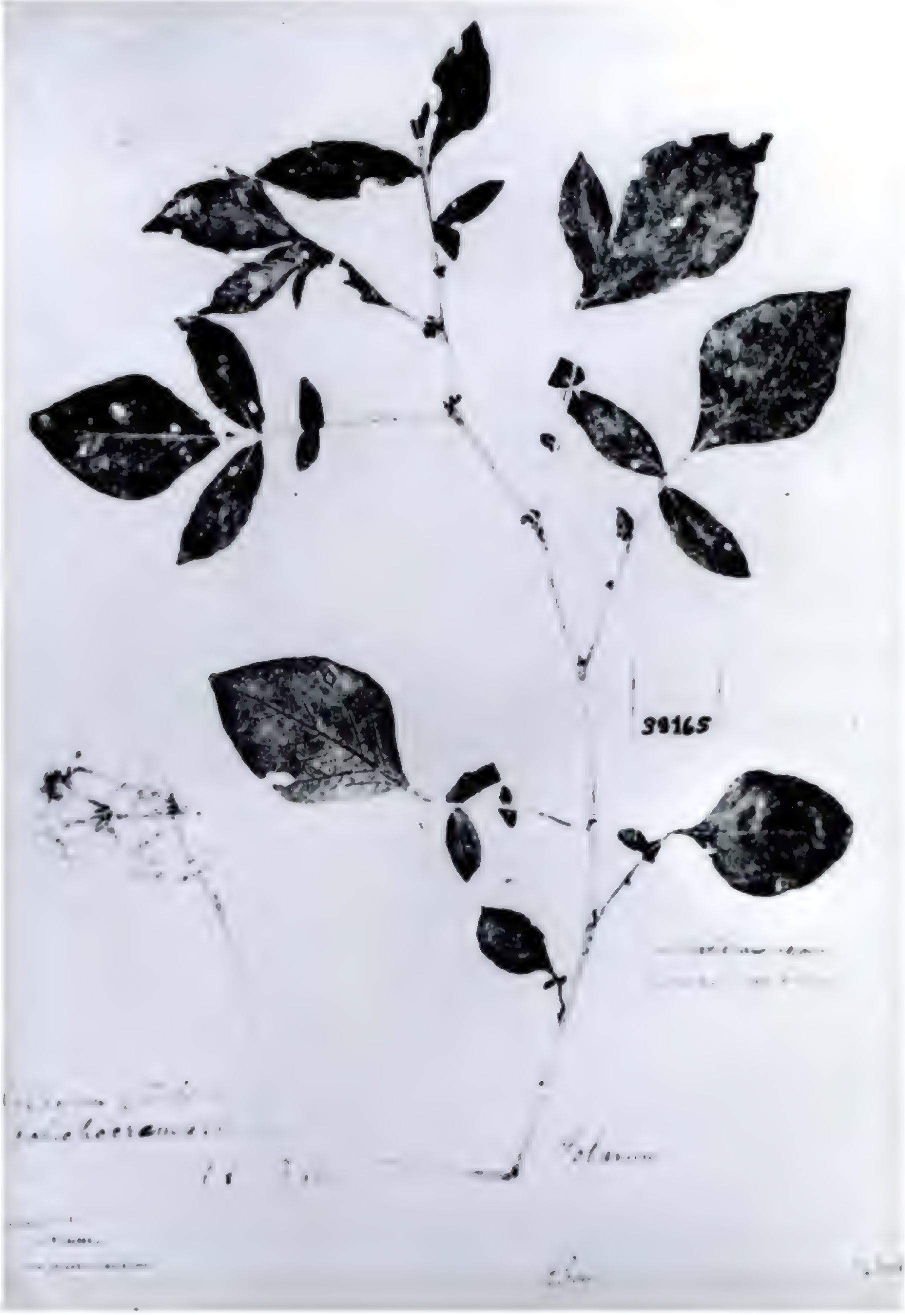


Figure 128. Type of *Solanum dolichocremastrum* (*Dombey s.n.* Peru).

narrowly elliptic-lanceolate, sessile and decurrent on the rachis; first upper pair of lateral leaflets (1.5-2.0-)3.0-5.5(-8.0) cm long by (1.0-1.5-)2.0-3.0(-5.0) cm wide, lanceolate to elliptic or narrowly elliptic-lanceolate, apex pointed to obtuse, base obliquely cuneate and decurrent about the rachis; the lowermost pairs of leaflets very small, 3-7 mm long by 1.5-4.0 mm wide; the veins and rachis pigmented dark purple. Pseudostipular leaves obsolescent or very small, 4-6(-8) mm long by 2-3 mm wide, falcate to obliquely elliptic. Inflorescence cymose to cymose-paniculate, (4-)6-10(-15)-flowered. Peduncle vigorous, slightly pigmented, occasionally bracted, biforked or triforked, (2.5-)3.0-5.0 cm long, pilose; pedicels pigmented very dark purple, almost black, pilose, slightly glandular, slender, (20-25-)35-45 mm long, articulated 5-7 mm below the calyx. Calyx pilose, almost black, 7-9 mm long, symmetrical; lobes ovate-lanceolate, abruptly narrowed to the 1.5-mm-long acumens, broadly membranous at base. Corolla rotate to rotate-pentagonal (or occasionally hexagonal-substellate), purplish violet to deep purple, 3.5-4.0(-4.5) cm in diam.; lobes 10-12 mm long by 15-20 mm wide, acumen margins densely pubescent (Fig. 130). Anther column conical-truncate, vigorous; anthers oblong-lanceolate or narrowly lanceolate, 5.5-6.5 mm long by 1.8 mm wide at base; filaments 1.0-1.5 mm long, glabrous; the base distinctly cordate. Style 10-11 mm long, very slender, shortly papillose below center; stigma capitate, small, slightly enlarged at the apex of the style. Fruit round, 1.7-2.2 cm in diam., dark green (Fig. 131). Chromosome number 2n=24. EBN=1.

Local names: *Papa de Gentil* in Llamellín, Ancash; *Jupay Papa* (= Devil's Potato) in Catac and Chavín, Ancash.

Type: PERU. Without exact locality or date, *J. Dombey s.n.* (holotype P).

Its possible that the French naturalist and explorer Joseph Dombey collected his sample of this species somewhere in the area bounded by the provinces of Huánuco and Huamalíes in the department of Huánuco in northern Peru. It is known that he visited this area from May 1780 to March 1781 as part of a botanical expedition sent to Peru by King Carlos III of Spain (see H. Ruiz, *Relación Histórica de los Viajes a los Reinos del Perú y Chile*, 2da. ed., I, p. 147-151 and 177-185, 1952).

In his classic monograph, Correll (1962) maintains *S. dolichocremastrum* as a separate and unique species based principally on the ovate-rhombic shape of the terminal leaflet and the slight degree of decurrency of the lateral leaflets, a combination of features not known from any other species at the time. However, new and additional collections of this entity have led to a better understanding of *S. dolichocremastrum*, which Correll suggests, ". . . is doubtless related to *S. chavinense*."

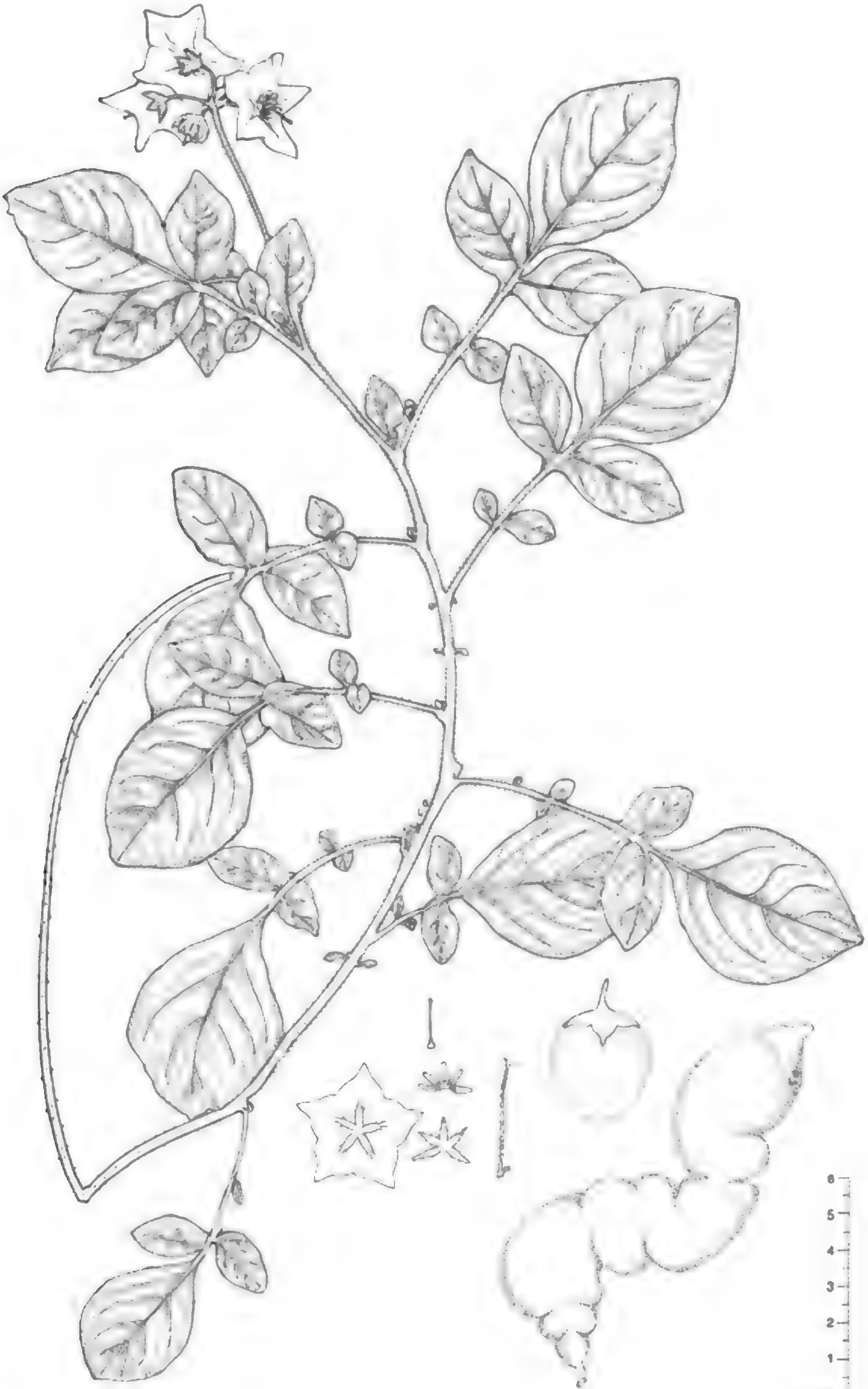


Figure 129. *Solanum dolichocremastrum* (*Ochoa 2378*, type collection of "*S. huanucense*").

The type collection of *S. dolichocremastrum* is housed in the Museum of Natural History at Paris. Unfortunately, the specimen is poor and without flowers (see photograph, Fig. 128). However, after reviewing more recent collections of this species plus Bitter's original and fairly detailed diagnosis of *S. dolichocremastrum* (this lacking only a description of corolla shape and color), I am more than convinced of the accuracy of the present taxonomic treatment. Moreover, two taxa that were formerly maintained as good species by Correll and Ochoa, *S. chavinense* and *S. huanucense*, are treated in this classification as synonyms of *S. dolichocremastrum*. Significantly, the several topotype collections of *S. chavinense* and *S. huanucense* that I examined during the preparation of this work are very similar, if not identical, to *S. dolichocremastrum* (*cf.* Correll's collections *P970* and *P972*, Lundell Herbarium, University of Texas, and Ochoa collections *2494*, *12070* and *12071*, CIP, OCH).

Correll maintained *S. chavinense* as a good taxonomic species on the basis of its decurrent lateral leaflets, winged pilose leaf rachis and pilose stem. However, his pen and ink illustration of the corolla of *S. chavinense* (this apparently also used as a factor in delimiting the species) was a reconstruction of this structure, as the type specimen, as mentioned earlier, is sterile. All the remaining characteristics of this entity, including its aforementioned vegetative features, fall within the pattern of variation of *S. dolichocremastrum*.

Affinities

This species bears some obvious resemblances to *S. medians*, especially with regard to leaf shape and the relatively large size of the terminal leaflet. The leaves of *S. medians*, however, are more greatly divided (including the presence of interjected leaflets) and the corolla is always rotate. Moreover, this species is a member of the cis-Andean region of Peru, an area that includes the central coast. *Solanum dolichocremastrum*, on the other hand, bears leaves that are only poorly dissected, lacks interjected leaflets, and has a corolla that varies from rotate to rotate-pentagonal. Unlike *S. medians*, this species is a member of the high Andes, or trans-Andean region of central Peru.

Habitat and Distribution

This species is known from the high-altitude jalcas and punas of Peru, two plant formations that are normally found between 3600 and 4400 m altitude. Depending on location, this species may be associated with grasses and herbs of the genera *Stipa*, *Ullucus* or *Loasa*, shrubs such as *Lupinus*, *Monnina* or *Astragulus*,

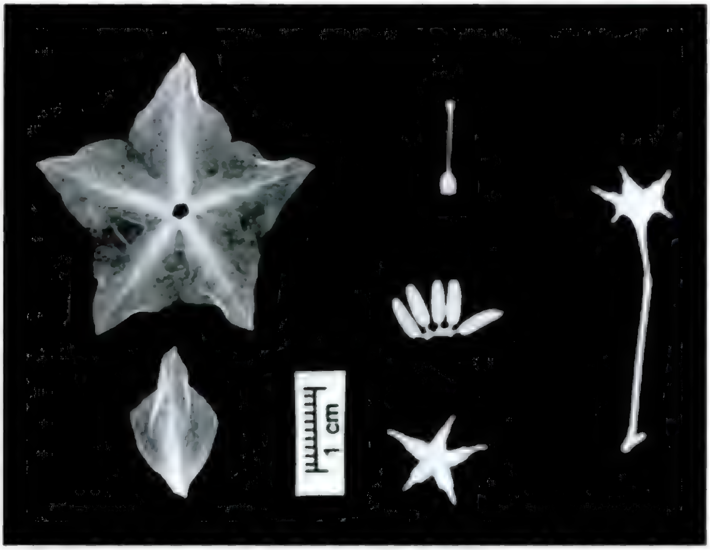


Figure 130. Floral dissection of *Solanum dolichocremastrum* (*Ochoa 12071*).

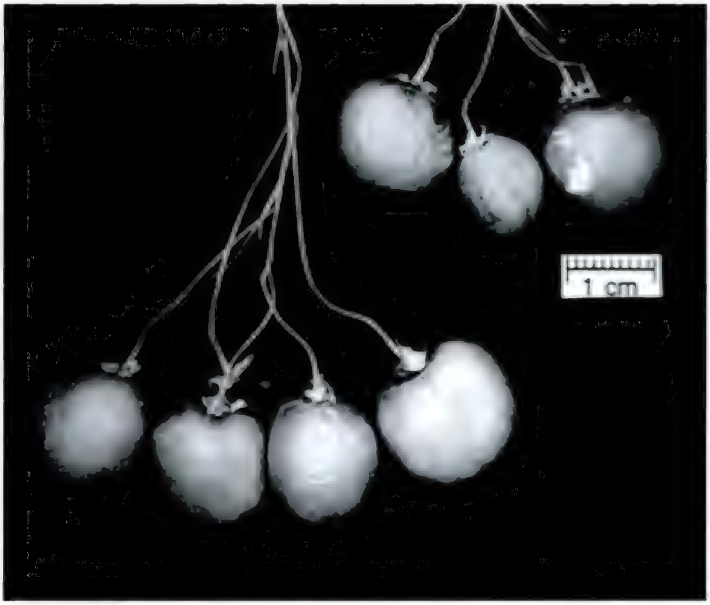


Figure 131. Fruits of *Solanum dolichocremastrum* (*Ochoa 12071*).

or small trees of the genera *Polylepis* and *Buddleja*. It occurs occasionally in the rich humus of deforested soils (*rosos de monte*), but is known also from much poorer soils, where it may grow among stones and rocks.

Solanum dolichocremastrum is distributed in the high mountains of the departments of Ancash, Huánuco and La Libertad. Its major area of distribution extends from the provinces of Huari and Carhuas (Ancash) to the provinces of Dos de Mayo and Huamalíes in northern Peru (Huánuco) (Map 13).

Specimens Examined

Department Ancash

Province Antonio Raimondi: Cerro Ccaccas, 4000 m alt., facing Llamellín, in grassland, n.v. *Papa del Gentil*, plants vigorous and pilose, the berries are called *shuruptas*, 20 April 1978, *C. Ochoa 12074*, 2n=24 (OCH and CIP, MOL, US, USM, from plants grown in the field at Huancayo, and CIP, MO, MOL, OCH, US, USM, from plants grown in the greenhouse at Huancayo). Lower foothills of Cerro Coto, near Llamellín, 3400 m alt., amid scrub, 20 April 1978, *C. Ochoa 12075* (OCH).

Province Carhuaz: District Shilla, near Punta Olímpica, 4000 m alt., heading up to Cuesta de Ulta along the new Carhuaz-Chacas highway, on stony hillsides, flowers deep purple, corolla 2.5 cm in diam., rotate-pentagonal or pentagonal, 24 February 1995, *C. Ochoa and R. Cabello 16201* (OCH). Cuesta de Ulta, 3750 m alt., heading up from Ulta toward Punta Olímpica on the road to Chacas, amid thickets of *Lupinus* sp. and *Bidens* and isolated trees of *Buddleja* and *Polylepis*, leaves usually with 2 pairs of leaflets, rarely 3, without interjected leaflets, with or without decurrency, corolla deep purple, 4 April 1995, *C. Ochoa and A. Salas 16205* (CIP, OCH). Cuesta de Ulta, 3800 m alt., heading upward toward Punta Olímpica on the road to Chacas, on gravelly slopes, among large stones, corolla deep purple, rotate-pentagonal and frequently rotate-hexagonal, large, up to 4.5 cm in diam., the leaflets of the leaves with or without very narrow decurrency, 4 April 1995, *C. Ochoa and A. Salas 16206* (CIP, MOL, OCH). Cuesta de Ulta, 3900 m alt., heading up toward Punta Olímpica on the road to Chacas, on gravelly slopes and in thickets of *Lupinus* sp., leaves with the leaflets of the first upper pair decurrent, 4 April 1995, *C. Ochoa and A. Salas 16207* (CIP, OCH). Cuesta de Ulta, 3900 m alt., heading up toward Punta Olímpica on the road to Chacas, on gravelly slopes, leaflets narrowly decurrent about the rachis, corolla deep purple, 4 April 1995, *C. Ochoa and A. Salas 16208* (CIP, OCH). Cuesta de Ulta, 3900 m alt., heading up toward Punta Olímpica on the road to Chacas, among small forests of *Polylepis* sp. with an understory of *Lupinus* and *Loasa*, growing near *Solanum chomatophilum*, corolla rotate-pentagonal, deep purple, 4 April 1995, *C. Ochoa and A. Salas 16209* (CIP, MOL, OCH, USM). Near the crest of Punta Olímpica, 4100 m alt., heading up via the Cuesta de Ulta, in forests of *Polylepis* sp., 4 April 1995, *C. Ochoa and A. Salas 16211* (CIP, MOL, OCH, UNTC, US, USM). Very near the crest of Punta Olímpica, 4100 m alt., in open field and amid thickets of *Lupinus* sp., leaflets ovate-lanceolate to almost orbicular-lanceolate, but in either case tending toward elongate-rhombic or rhomboid, tubers white, long subcylindrical to submoniliform, 4-5 cm long, 4 April 1995, *C. Ochoa and A. Salas 16212* (CIP, MOL, OCH, UNTC, USM). Near the crest of Punta Olímpica, 4100 m alt., heading up via the Cuesta de Ulta, in an open field in deforested soils (*rosos de monte*) with abundant humus and ash, corolla deep purple, rotate-pentagonal, 4 April 1995, *C. Ochoa and A. Salas 16217* (CIP, MOL, OCH, UNTC, USM).

Province Huaraz: Huascarán National Park, Shallap quebrada (77°23' W, 09°30 S), 3900 m alt., overgrazed bottom, grassland with some shrubs, erect herb, 70 cm tall, flowers deep blue-purple, anthers yellow, in boulders, freshly burned spot, 20 February 1985, *D.N. Smith, R. Valencia and A. Gonzales 9680* (MO, UNTC).

Province Huari: Growing among large boulders near pass between Recuay and Chavín, 4100 m alt., flowers purplish, rotate to broadly rotate-stellate, tubers orbicular, white, up to 1.5 cm in diam., 30 March 1960, *D.S. Correll and E.E. Smith P967* (F, LL). Growing among large boulders near pass between Recuay

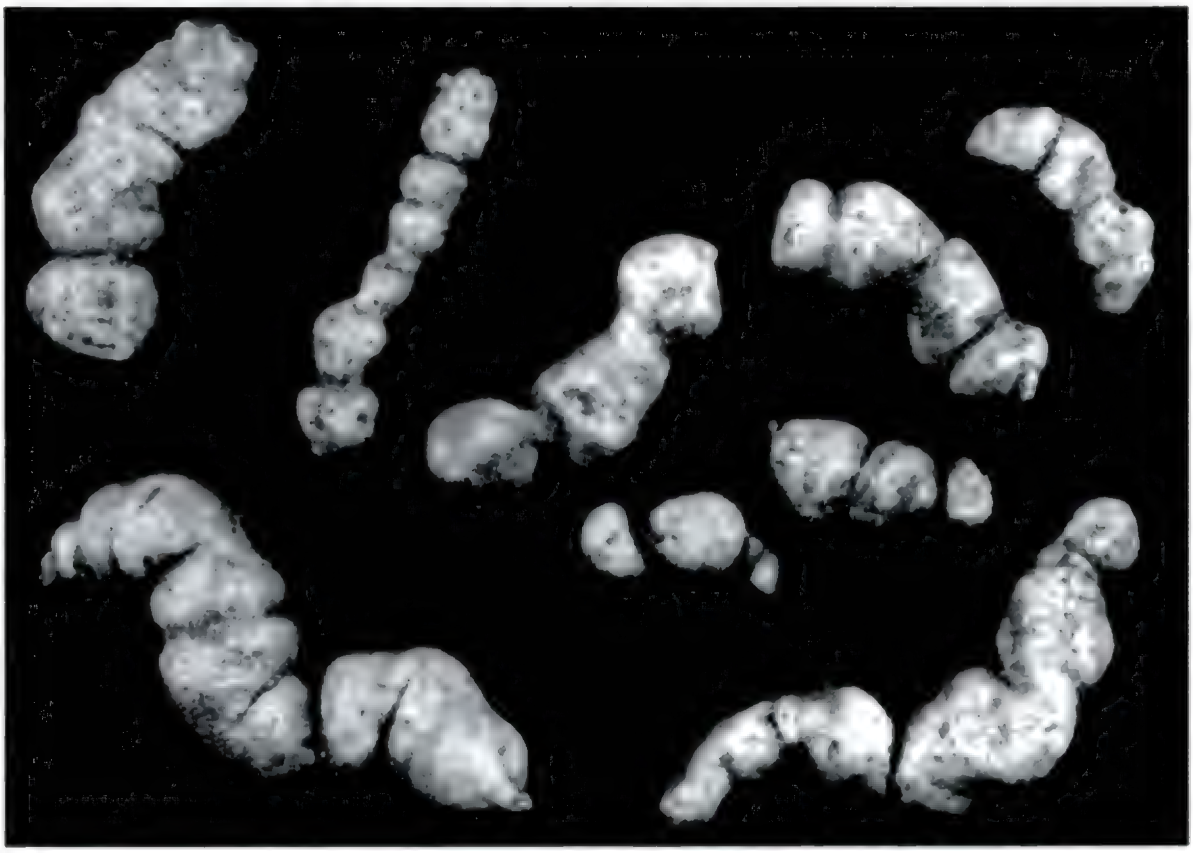


Figure 132. Tubers of *Solanum dolichocremastrum* (*Ochoa 13018*).

and Chavín, 4100 m alt., flowers deep purple, flat, broadly rotate-stellate, tubers white brittle, oblong to orbicular, up to 4 cm long, 30 March 1960, *D.S. Correll and E.E. Smith P970* (LL). Among brush about boulders, 15 km above Chavín, 3900 m alt., flowers purple, stellate to rotate-stellate, fruit suborbicular, compressed, 2 cm long, 30 March 1960, *D.S. Correll and E.E. Smith P972* (LL, NY). Among boulders and trees near pass between Recuay and Chavín, 4200 m alt., flowers lavender to purple, broadly stellate, fruits oblong, 30 March 1960, *D.S. Correll and E.E. Smith P973* (LL, US, USM, type collection of "*S. chavinense*"). Cutarengua, 4250 m alt., near Cawish Pass, among large rocks and trees of *Buddleja* sp. with an understory of *Stipa* sp. and *Loasa* sp., heading down from the tunnel toward Chavín, 16 April 1963, C. *Ochoa 2494* (topotypes MOL, OCH, USM). Between the tunnel of Cawish and Chavín, near Cawish Pass, 4250 m alt., plants senescent, very mature, tubers and a few plants for transplanting were collected, 27 May 1977, C. *Ochoa 11700*, 2n=24 (topotype OCH and CIP, MOL, OCH, from plants grown in fields at Huancayo). Near Cawish Pass, past the tunnel on the road to Chavín, 4350 m alt., only living plantlets were collected, 13 April 1978, C. *Ochoa 12070*, 2n=24 (CIP, MOL, OCH, USM, from plants grown in fields at Huancayo from plantlets collected at the original locality, and CIP, MOL, OCH, from plants reproduced in the greenhouse at Huancayo). Tambillo, 3900 m alt., heading down from Cawish Pass toward Chavín, near the bridge of the Cawish River, 13 April 1978, *C. Ochoa 12071*, 2n=24 (OCH; CIP, MO, MOL, OCH, US, USM, from plants grown at La Molina, Lima, and CIP, MOL, OCH, USM, from plants grown in the greenhouse at Huancayo), and *12072*, 2n=24 (CIP, OCH, from original plants, and CIP, MOL, OCH, from plants grown in the greenhouse at Huancayo). Shirapata, 3600 m alt., on the Cawish-Chavín road, growing near *S. albicans*, cuttings only were collected, 16 April 1978, C. *Ochoa 12083A* (CIP, OCH, from plants propagated from original cuttings in fields at Huancayo). Between Recuay and Chavín, near Cawish Pass, past the tunnel (Cawish), ca. 4000 m alt., in relic formations of *Polylepis* sp., among large rocks, in very moist and stony soils, April 1978, C. *Ochoa and A. Salas 12607* (OCH). Huachococha, 4400 m alt., between San Luis and Huari, growing near *S. chomatophilum*, 10 May 1978, *C. Ochoa 13012A*, 2n=24 (OCH). Between San Luis and San Marcos, 3900 m alt., 1 km before San Marcos, in the foothills of the mountain, 10 May 1978, *C. Ochoa 13013*, 2n=24 (CIP, MOL, OCH, from field plants at Huancayo, and CIP, MOL, OCH, USM, from plants grown in fields at La Molina, Lima). Huascarán National Park, upper terrace of Pachachaca, a lateral valley of Ruvichinchay (77°17' W, 09°23' S), 4040-4200 m alt., bogs, streamsides, grassland in bottom, *Lupinus* community and *Polylepis weberbauerii* woods on slopes, herb, flowers medium violet, growing among large boulders, understory of *Polylepis weberbauerii* woods, 13 June 1986, *D.N. Smith, A. Gonzales and D. Maldonado 12591* (MO, UNTC).

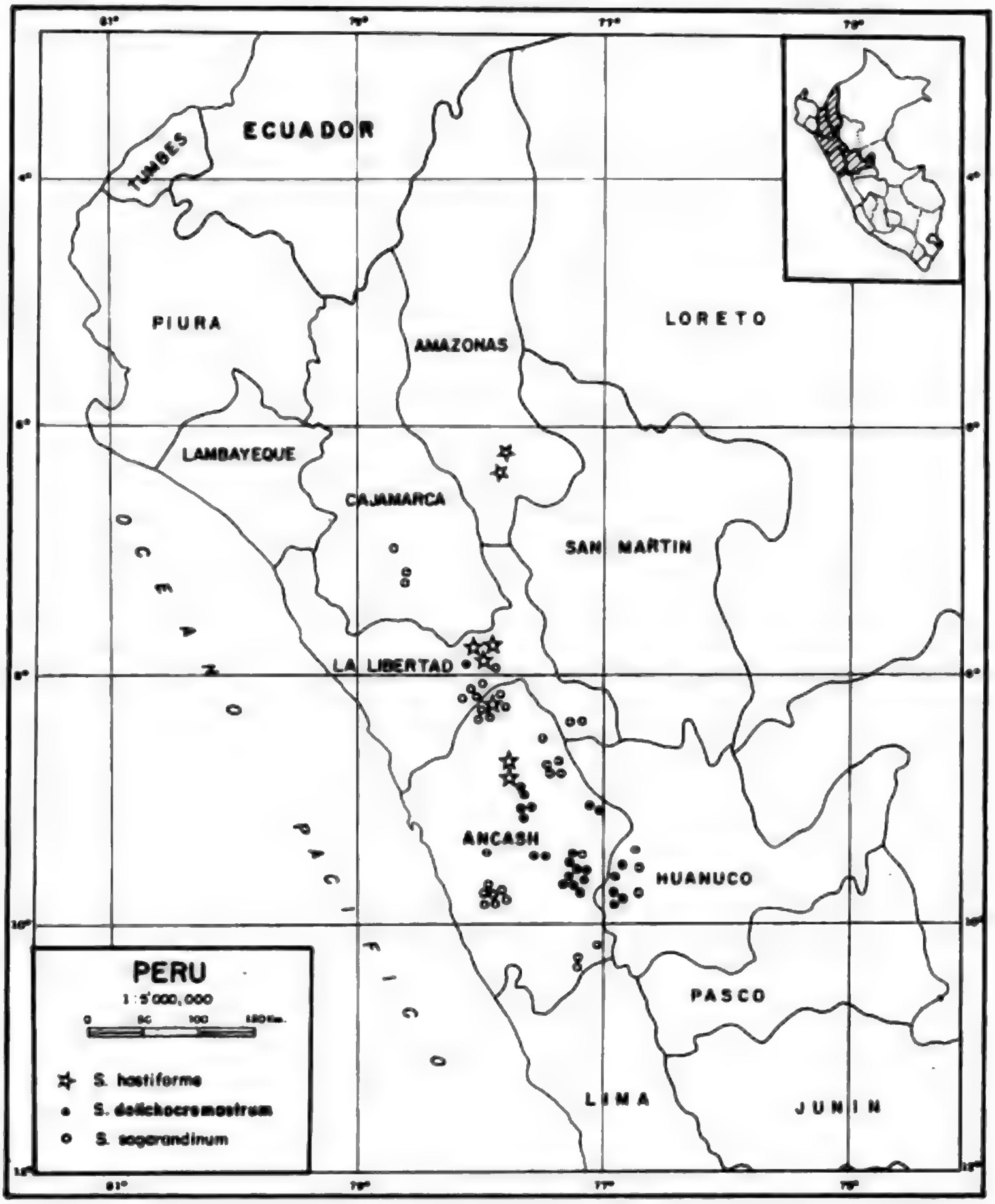
Province Recuay: Tambillos, 3950 m alt., down the road from Cawish Pass toward Chavín, on stony slopes, berries ovoid, green, tubers white-hyaline, 1-2 cm, 16 April 1963, *C. Ochoa 2496* (MOL, OCH). Keñuacuto, 4100 m alt., at km 40 on the Catac-Chavín road, past the Cawish tunnel toward Chavín, among large rocks and borders of *Polylepis* sp. tree thickets, associated with *Stipa* sp., *Loasa*, *Urtica*, *Oxalis* and thickets of Compositae, in very moist black soils, leaves with little or no decurrency, 3 April 1995, *C. Ochoa and A. Salas 16202* (CIP, MOL, OCH, UNTC). Near Keñuacuto, 4100 m alt., at km 40 on the Catac-Chavín road, past the Cawish tunnel toward Chavín, within forests of *Polylepis* sp., in very shady places and in soils very moist and humid, leaves decurrent, 3 April 1995, *C. Ochoa and A. Salas 16203* (CIP, GH, MOL, OCH, US, USM). Ayamachay, 4000 m alt., near km 31 on the Catac-Chavín road, about 5 km before the entrance to the Cawish tunnel, on the road to Chavín, plants small, 20-30 cm tall, with leaflets broadly ovate-rhombic to rhombic-lanceolate with broad decurrency about the rachis, very similar to "*S. huanucense*", growing near *S. acaule*, berries ovoid to round, n.v. *Jupay Papa* (= Devil's Potato), 7 April 1995, *C. Ochoa and A. Salas 16218* (CIP, MOL, OCH, USM). Condecorral, 4100 m alt., near km 32 on the Catac-Chavín road, before going through the Cawish tunnel, on a stony slope and among large rocks, berries ovoid, dark green, 7 April 1995, *C. Ochoa and A. Salas 16220* (CIP, MOL, OCH, US, USM).

Province Yungay: Quishuar, 4150 m alt., heights of the Santa Cruz quebrada, heading down via the passage from Santa Cruz on the road to Laguna Grande, May 1978, *C. Ochoa 13017* (CIP, MOL, OCH). Suika Ckuchu, 4100 m alt., about 3 km before Laguna Grande, heading up from Huaripampa, by the Santa Cruz quebrada, tubers usually large, 5-6 cm long, fusiform, also smaller and moniliform, white, 12-16 May 1978, *C. Ochoa 13018* (OCH, from plants grown at Huancayo).

Department Huánuco

Province Dos de Mayo: Ranracancha, 3780 m alt., in the hamlet of Huayochano, District Chavinillo, on stony slopes, associated with *Stipa* sp., plants very young, without flowers, 5 May 1961, *C. Ochoa 2374* (OCH). Lower slopes of Cerro Huanca, 3700 m alt. (eastern side), near Chasqui, Distr. Jacas, May 1961, *C. Ochoa 2378* (MOL, OCH, USM, type collection of "*S. huanucense*"). Foothills of Cerro Huanca, 4075 m alt., near Jacas Chico, among large tufts of *Stipa* sp., very susceptible to *Phytophthora infestans* and *Alternaria solani*, 20 April 1967, *C. Ochoa 2628* (MOL, OCH, USM).

Province Huamalíes: Hills in the vicinity of the Carpa lagoon, 3660 m alt. (south side), Distr. Tantamayo, at the entrance of a cave, n.v. *Curao Machay*, April 1961, *C. Ochoa 2362* (OCH). Cerro Huanca, 3650 m alt., near Chasqui,



Map 13. Distribution of *Solanum hastiforme, S. dolichocremastrum* and *S. sogarandinum.*

Distr. Jacas, only tubers were collected, April 1962, *C. Ochoa 2403*, 2n=24 (OCH, from a plant propagated at the Universidad Nacional Agraria La Molina, Lima, 25 October 1962). Lower foothills of Cerro Nieva, facing Jacas Grande, 3650 m alt., 21 April 1967, *C. Ochoa 2629* (OCH).

Department La Libertad

Province Santiago de Chuco: Among shrubs on seepage slope a few km below Quiruvilca, 3500 m alt., 27 March 1960, *D.S. Correll and E.E. Smith P942* (LL).

Locality Indefinite

Without date or exact collection site: *J. Dombey s.n.* (P, type collection of *S. dolichocremastrum*).

Breeding Potential

Compatibility was obtained in reciprocal crosses of *S. dolichocremastrum* with *S. lignicaule*, and in unilateral crosses with *S. immite* (all 2n=24 and EBN=1). Reciprocal crosses with *S. multiinterruptum*, *S. medians*, *S. jalcae* and *S. sogarandinum*, although involving species of different endosperm balance number (EBN=2) and different series, were also successful. However, crosses between two other diploid species of EBN=2, *S. chomatophilum* from series Conicibaccata, and *S. huarochiriense* from series Tuberosa, were successful only when the aforementioned plants were used as female parents. Again, crosses of *S. bukasovii* and *S. candolleanum* from series Tuberosa with *S. dolichocremastrum* from series Megistacroloba were successful only when the former species were used for female parents, but, in this case, very few (2-3) fertile seeds were obtained per fruit, despite the large number of berries that were formed. On the other hand, reciprocal crosses involving *S. chiquidenum*, *S. ancophilum*, *S. megistacrolobum* and *S. raphanifolium* (all diploids with EBN=2) all ended in failure. But unilateral crosses of *S. dolichocremastrum* with *S. megistacrolobum* var. *toralapanum* (2n=24 and EBN=2) and *S. acaule* (2n=48 and EBN=2) were successful, though fertile seed set in each case was very low. Lastly, all direct or unilateral crosses of this species with *S. amayanum* and *S. rhombilanceolatum* (both EBN=2) and *S. albicans* (EBN=4) ended in failure (see Table 31).

Table 31. Fertility of *Solanum dolichocremastrum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note following Table 1 for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	Lignicaulia	× *S. lignicaule*	6(2)	5(2)	70(29)
24	1	Tuberosa	× *S. immite*	18	10	7
24	2	Conicibaccata	× *S. chomatophilum*	12(44)	4(18)	0(64)
			× *S. rhombilanceolatum*	8	4	0
24	2	Ingaefolia	× *S. jalcae*	8(13)	3(12)	21(51)
24	2	Megistacroloba	× *S. megistacrolobum*	13(5)	3(5)	0(0)
			× *S. megistacrolobum* var. *toralapanum*	10	1	5
			× *S. raphanifolium*	25(19)	17(4)	0(0)
			× *S. sogarandinum*	15(26)	5(13)	8(53)
24	2	Piurana	× *S. chiquidenum*	27(5)	25(5)	0(0)
24	2	Tuberosa	× *S. amayanum*	7	2	0
			× *S. ancophilum*	8(6)	0(0)	0(0)
			× *S. bukasovii*	44(58)	31(32)	0(3)
			× *S. candolleanum*	15(26)	6(18)	0(2)
			× *S. coelestispetalum*	15(18)	12(0)	4(0)
			× *S. huarochiriense*	3(5)	1(2)	0(70)
			× *S. medians* var. *autumnale*-2x	10(11)	4(5)	27(24)
			× *S. multiinterruptum*	22(23)	17(14)	190(70)
48	2	Acaulia	× *S. acaule*	7	4	3
72	4	Acaulia	× *S. albicans*	5	1	0

FL = total number flowers pollinated, TB = total number berries obtained, SB = average number seeds per berry.

Table 32. Collections (OCH) used in *Solanum dolichocremastrum* fertility studies.

ACAULIA
S. acaule 10111, 14929
S. albicans 13019

CONICIBACCATA
S. chomatophilum 11856, 13210, 13258
S. rhombilanceolatum 13112

INGAEFOLIA
S. jalcae 14490

LIGNICAULIA
S. lignicaule 11617

MEGISTACROLOBA
S. dolichocremastrum 12070, 12071, 12072, 12074, 13013
S. megistacrolobum 15620
S. megistacrolobum var. *toralapanum* 13544
S. raphanifolium 13577, 13612, 13704, 13759, 15125
S. sogarandinum 13006, 13324

PIURANA
S. chiquidenum 13963

TUBEROSA
S. amayanum 4299
S. ancophilum 12099
S. bukasovii 11330, 13559, 13725, 14333, 14498, 15202
S. candolleanum 14958, 14959
S. coelestispetalum 13605, 13632
S. huarochiriense 11331, 14525
S. immite 13346
S. medians-2x 11637
S. multiinterruptum 11693, 12057A, 14677

28. *Solanum hastiforme* Corr., Wrightia 2:187-188, 1961; *The Potato and Its Wild Relatives*, p. 328-329, Fig. 125, 1962.

Figs. 133-134; Map 13; Plate XIII.

Plant erect to erect-ascending, small, (10-)15-25(-35) cm tall, coarsely pubescent on all parts, hairs mostly simple but mixed with short tetralobular glandular hairs, stoloniferous and tuber-bearing. Stem simple or little branched, slender, straight or slightly flexed; internodes (0.8-)1.5-2.5(-3.5) cm long; stolons long and slender, 30-70(-100) cm long, frequently giving rise to new plants; tubers occasionally moniliform, round to ovoid, white or white diffused with violet, very small, 8-12 mm in diam. Leaves simple or with 1-2 pairs of very small lobes situated near the base of the terminal leaflet, giving it the appearance of a lance or halberd (and hence the origin of the name of this species). Leaves (3-)5-6(-8) cm long by (2.0-)2.5-3.0(-4.0) cm wide, very pilose on both sides and along the margins of the leaflets; hairs white, short, pointed and coarse. Petiole 0.5-1.0 cm long; terminal leaflet or blade (3-)4-6(-7) cm long by (2.0-2.5-4.0 cm wide, ovate

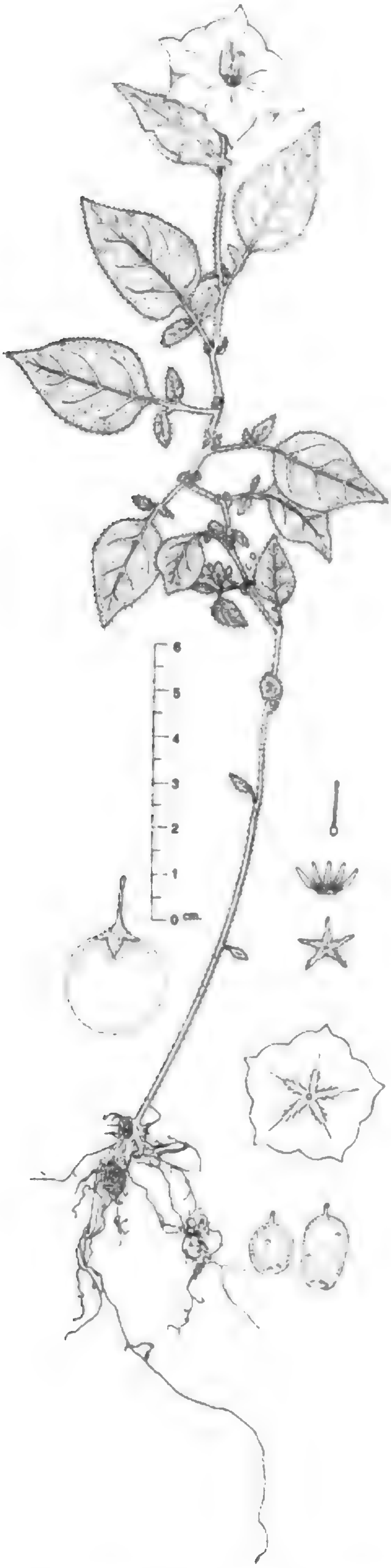


Figure 133. *Solanum hastiforme* (*Ochoa 2517*).

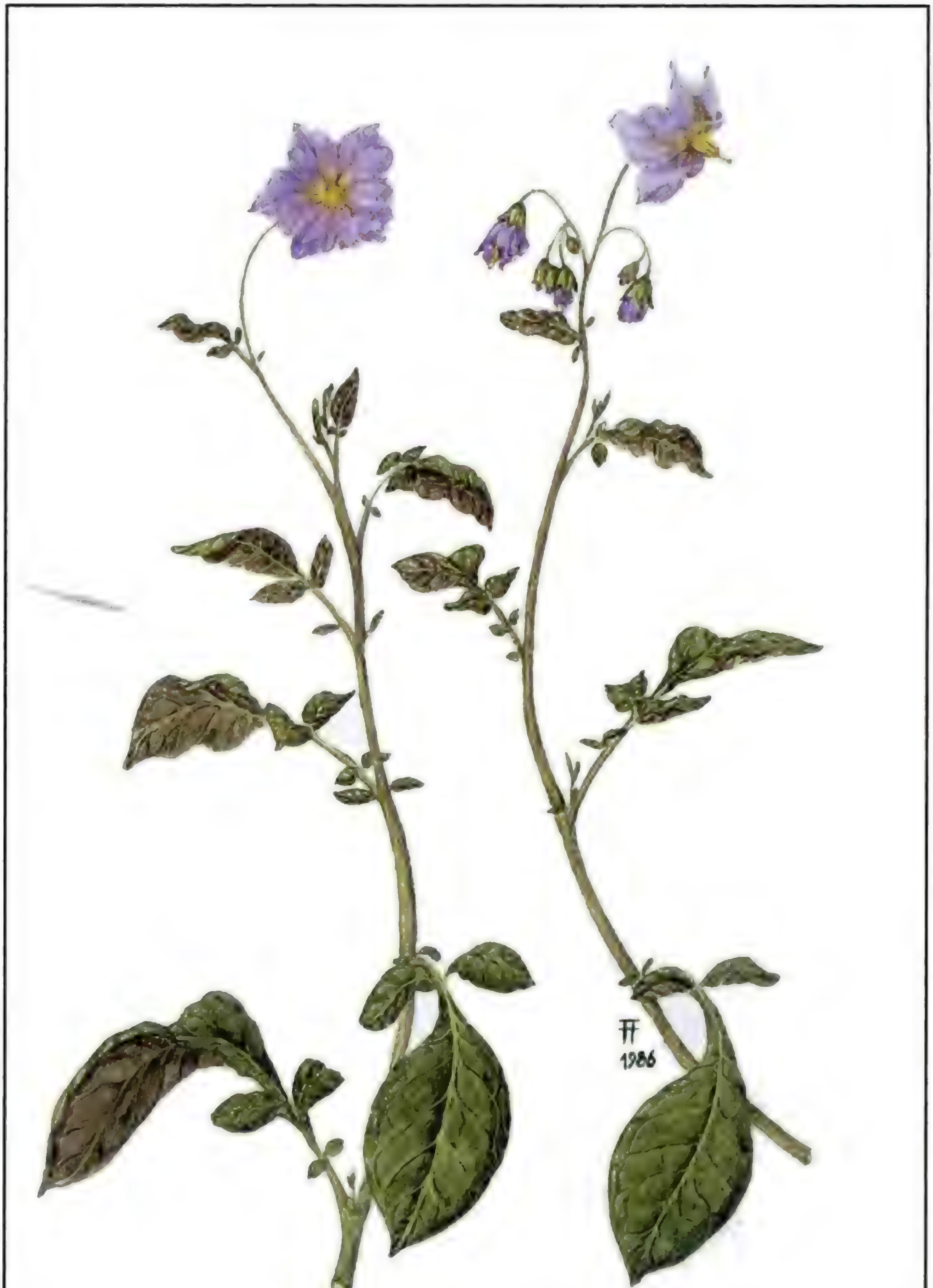


Plate XIII. *Solanum hastiforme* Corr.

to ovate-elliptic, the apex subobtuse or pointed, base broadly cuneate and narrowly decurrent; lateral lobes or leaflets elliptic to narrowly elliptic-lanceolate, (0.6-)0.8-1.2(-1.5) cm long. Pseudostipular leaves broadly falcate or subelliptic, 0.5-1.0 cm long, narrowly decurrent about the rachis. Inflorescence terminal, cymose, 1-5(-8)-flowered. Peduncle short, 0.8-1.5 cm long; pedicels 2-3 cm long, densely pubescent; articulated 6-7 mm below the base of the calyx. Calyx symmetrical or asymmetrical, densely pubescent, 6-7 mm long, with triangular-lanceolate lobes and attenuate apex; acumens pointed, 1.5 mm long. Corolla rotate, 3 cm in diam., purple or violet. Anthers lanceolate, 6 mm long, with a well-defined dorsal groove, base cordate; filaments 1.0-1.5 mm long, glabrous. Style 10 mm long, exserted 2 mm, very fine, papillose and sparsely setose along the lower half of its length; stigma claviform to capitate, very small, slightly enlarged at the apex of the style. Fruit round, 1.5-1.8 cm in diam., pale green, marked with very small white dots, not verrucose (Fig. 134). Chromosome number 2n=24. EBN=2.

Local name of the fruit: *Candullpa* in Pallasca, Ancash.

Type: PERU. Department La Libertad, [Province Sánchez Carrión], along a small stream, near shrubs and rocks, 3200 m alt., about 3 km west of Huamachuco, 27 March 1960, *D.S. Correll and E.E. Smith P930* (lectotype US, here designated; isotype LL).

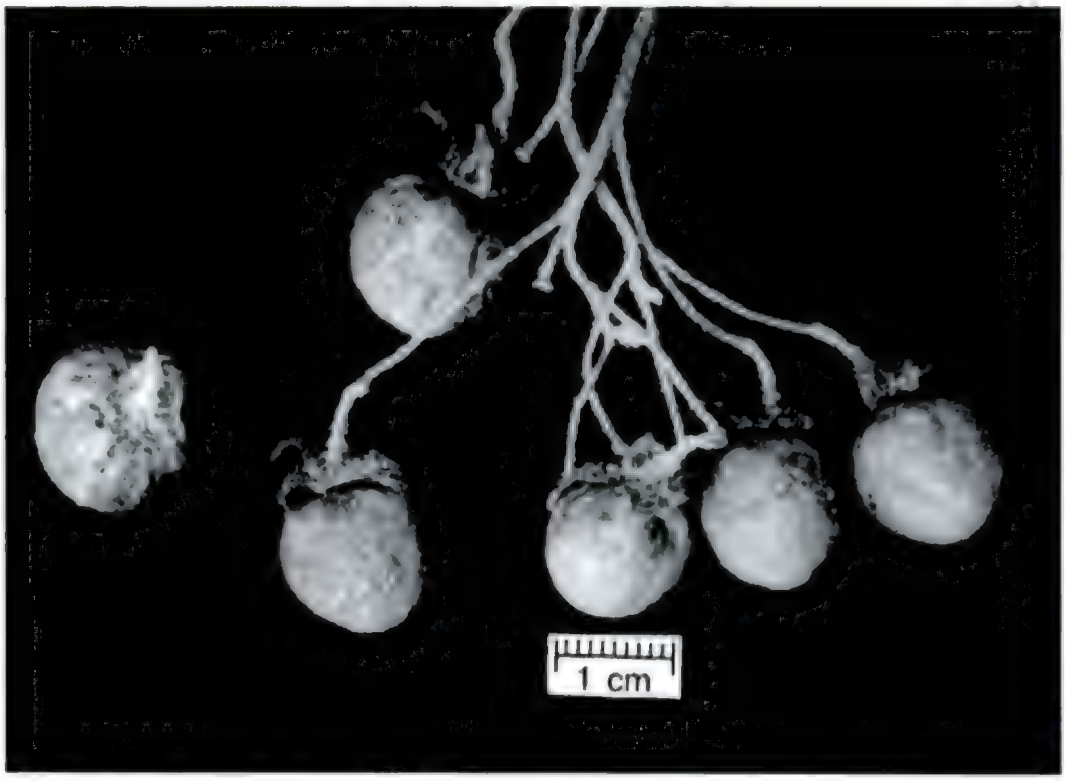


Figure 134. Fruits of *Solanum hastiforme* (*Ochoa 13290*).

Affinities

Related to *S. ancophilum*. Features of *S. hastiforme* that are similar to those of *S. ancophilum* include the habit and indumentum of the plant, the large rotate corolla and the occurrence of up to two pairs of lateral leaflets on the leaves of the better-developed plants.

Habitat and Distribution

This species grows preferentially in the moist, middle-altitude inter-Andean valleys and jalcas of northern Peru. It is generally encountered between 3000 and 3500 m altitude, although plants growing at altitudes as low as 2800 m and as high as 3900 m have been reported. Various species are associated with *S. hastiforme* depending upon habitat. In *jalca* areas, this species grows among grasses and woody species of *Barnadesia* and *Eupatorium*, whereas in its quebrada habitats, this species frequently grows along steep escarpments in thickets of herbs and shrubs. On the steep slopes and rocky skirts found in the vicinity of the pampas of Huaguil, province Sánchez Carrión, it commonly grows among bunches of *Calceolaria weberbaueriana*, *Senecio* spp., and the wild tuber-bearing *Solanum chomatophilum*. Its distribution encompasses the departments of Ancash, La Libertad and Amazonas in northern Peru (i.e., from 09°45' S and 77°87' W to 06°00' S and 77°41' W) (Map 13).

Specimens Examined

Department Amazonas

Province Chachapoyas: Tambillo, 2850 m alt., near the right bank of the Tambillo River, on the Leimebamba-Atuén road, 31 March 1979, C. *Ochoa 13251*, 2n=24 (CIP, GH, MO, MOL, OCH, US, USM). Jalcas of Atuén, 3300 m alt., among grasses and wild *Ullucus*, abundant; pedicels, peduncles, calyx and floral buds densely pilose, 31 March 1979, *C. Ochoa 13252* (OCH, from plants grown in the greenhouse at Huancayo).

Department Ancash

Province Huaylas: Auquispuquio, 3800-3900 m alt. (77°58' W, 08°50' S), Huascarán National Park, area of ruins, grassland, intermitently grazed or cultivated, steep slopes, herb, erect, flowers purple, tuber-bearing, 7 April 1986, *D.N. Smith, M. Buddensiek and R. Valencia 11923* (HUT, MO, OCH, USM). Auquispuquio, 3800-3900 m alt. (77°58' W, 08°50' S), Huascarán National Park, rosette herb with tubers, flowers blue-purple, 7 April 1986, *D.N. Smith, M. Buddensiek and R. Valencia 11993* (USM).

Province Pallasca: Las Panisaras, 3375 m alt., between Pallasca and Huandoval, tubers small, moniliform, 26 May 1963, *C. Ochoa 2517* (OCH). Onocrupa, 3380 m alt., above Cabana, 27 May 1963, *C. Ochoa 2522* (MOL, OCH, UNTC, US, USM). Cerro Yacúa, ca. 3400 m alt., above Ancos, Distr. Miraflores, 4 March 1967, *C. Ochoa 2612* (MOL, OCH).

Department La Libertad

Province Sánchez Carrión: Along brushy rocky stream about 3 km west of Huamachuco, 3200 m alt., flowers purple-lavender, rotate-pentagonal, tubers small, 27 March 1960, *D.S. Correll and E.E. Smith P930* (LL, US, type collection of *S. hastiforme*). Near Quebrada del Diablo, 3200 m alt., about 3 km west of Huamachuco, among shrubs (*Eupatorium*, *Barnadesia*, *Calceolaria*), scarce, flowers violet, 24 March 1964, *C. Ochoa and J.G. Hawkes 2553* (OCH). On steep slopes of a rocky mountain east-northeast of the pampas of Huaguil, 3600 m alt., in large rock crevices in humic soil, among tufts of *Stipa ichu*, *Plantago* sp., *Senecio* sp. and abundant *Calceolaria weberbaueriana*, plants very pubescent and susceptible to *Phytophthora infestans*, 1 May 1979, *C. Ochoa 13290*, 2n=24 (CIP, MO, MOL, OCH, US, USM).

Breeding Potential

Little data is available on the crossability of *S. hastiforme*. The single species cross involved *S. hastiforme* No. *13290* and *S. mochiquense* No. *14870* (2n=24 and EBN=1). Reciprocal crosses worked in both directions, but a high average number of seeds per berry was obtained only when *S. mochiquense* was used as the pistillate parent.

29. *Solanum megistacrolobum* Bitt., Repert. Sp. Nov. 10:536-537, 1912. Figs. 135-139; Map 14.

S. alticola Bitt., Repert. Sp. Nov. 12:5-6, 1913. Type: *Mandon 398*, BOLIVIA, near mount Sorata, Department La Paz, Province Larecaja, 1860 (P).

S. alticolum Bitt. var. *xanthotrichum* Hawkes, Bull. Imp. Bur. Pl. Breed. & Genet., Cambridge 42, 120, Fig. 26, 1944. Type: *Balls 5986 p.p.* and *5981 p.p.*, ARGENTINA, Province Jujuy, San Gregorio, 4000 m alt., above Tilcara (CPC).

S. tilcarense Hawkes, Bull. Imp. Bur. Pl. Breed. & Genet., Cambridge 41, 119-120, Pl. II (b), Fig. 25, 1944. Type: *Balls 5986 p.p.*, ARGENTINA, Province Jujuy, San Gregorio, 4000 m alt., above Tilcara (CPC).

Plant small, forming rosettes 8-10 cm in diam. or caulescent and branching-decumbent, (5-)10-35 cm tall by 2-5 mm in diam. at base, subglabrous or sparsely pilose with brilliant white hairs. Stolons 90 cm or more long; tubers small, 1-2 cm long, round to ovoid, slightly compressed, occasionally moniliform, whitish yellow to pale brown, rarely dark purple. Leaves simple or imparipinnate to pinnati-lobed, (3-)7-15(-23) cm long by (2.0-)3.0-5.5(-8.0) cm wide, with (0-)1-3(-4) pairs of small or very reduced leaflets, gradually decurrent upon the petiole, without interjected leaflets, sparsely pilose, hairs short, thick and adpressed on the upper surface and along the margins, more densely and shortly pilose on the veinlets, but with longer and more conspicuous hairs on the rachis and the veins of the lower surface; petiole 1.5-2.5(-4.0 cm) long. Terminal leaflet or blade, in the case of the simple leaves, (2.0)4.0-8.5(-15.5) cm long by (1.0-)2.5-4.0(-7.0) cm wide, very polymorphic, ranging from suborbicular, elliptic, ovate-elliptic, oblanceolate or long elliptic to obovate, or from long ovate to long oblong to occasionally rhombic; the apex varying from broadly rounded to obtuse and apiculate, and the base from broadly rounded to cuneate or, in rosette-forming plants, gradually decurrent about the petiole or occasionally truncated. Lateral leaflets much smaller than the terminal, 1-4 cm long by 0.5-2.8 cm wide, gradually diminishing in size toward the base, generally ovate-elliptic to oblong, the apex rounded, obtuse or rarely pointed, more or less narrowly decurrent about the rachis on the basiscopic side. Pseudostipular leaves minute, scarcely visible or lacking. Inflorescence lax, 1-4(-8)-flowered. Peduncle short or lacking in dwarf or rosette-forming plants, 0-4(-7) cm long, simple or rarely biforked; pedicels either short (2-3 cm) or long (8-10 cm), sparsely pilose, somewhat glandular, articulated 4-12 mm below the calyx. Calyx 4-6(-9) mm long, sparsely pilose, symmetrical or occasionally asymmetrical, pointed or shortly acuminate; lobes clearly defined, varying from ovate-triangular to ovate-lanceolate. Corolla 2.5-3.0(-3.5) cm in diam., rotate-pentagonal to substellate (rarely hexagonal or heptagonal) (Fig. 137), frequently lilac or bluish-lilac to deep purple; lobes much broader than long and little delimited from the externally pubescent acumens. Anthers 4-5 mm long by 1.8 mm broad at base, occasionally somewhat lobulate at base; filaments 1.0-1.5 mm long, glabrous. Style 7-10 mm long, glabrous or very sparsely papillose along the basal one-third of its length; stigma shortly capitate or completely claviform, split or strongly grooved, bilobed or almost bifid. Fruit 1.5-2.0(-2.5) cm in diam., globose to ovate-pyriform or ovoid, occasionally slightly laterally compressed, green to dark green. Chromosome number 2n=24. EBN=2.

Local names: *K'itta Papa* (= Wild Potato) in Piquillakkta, province Quispicanchis, department Cusco; *Alkko Papa* (= Dog Potato) in the province Acomayo, department Cusco.

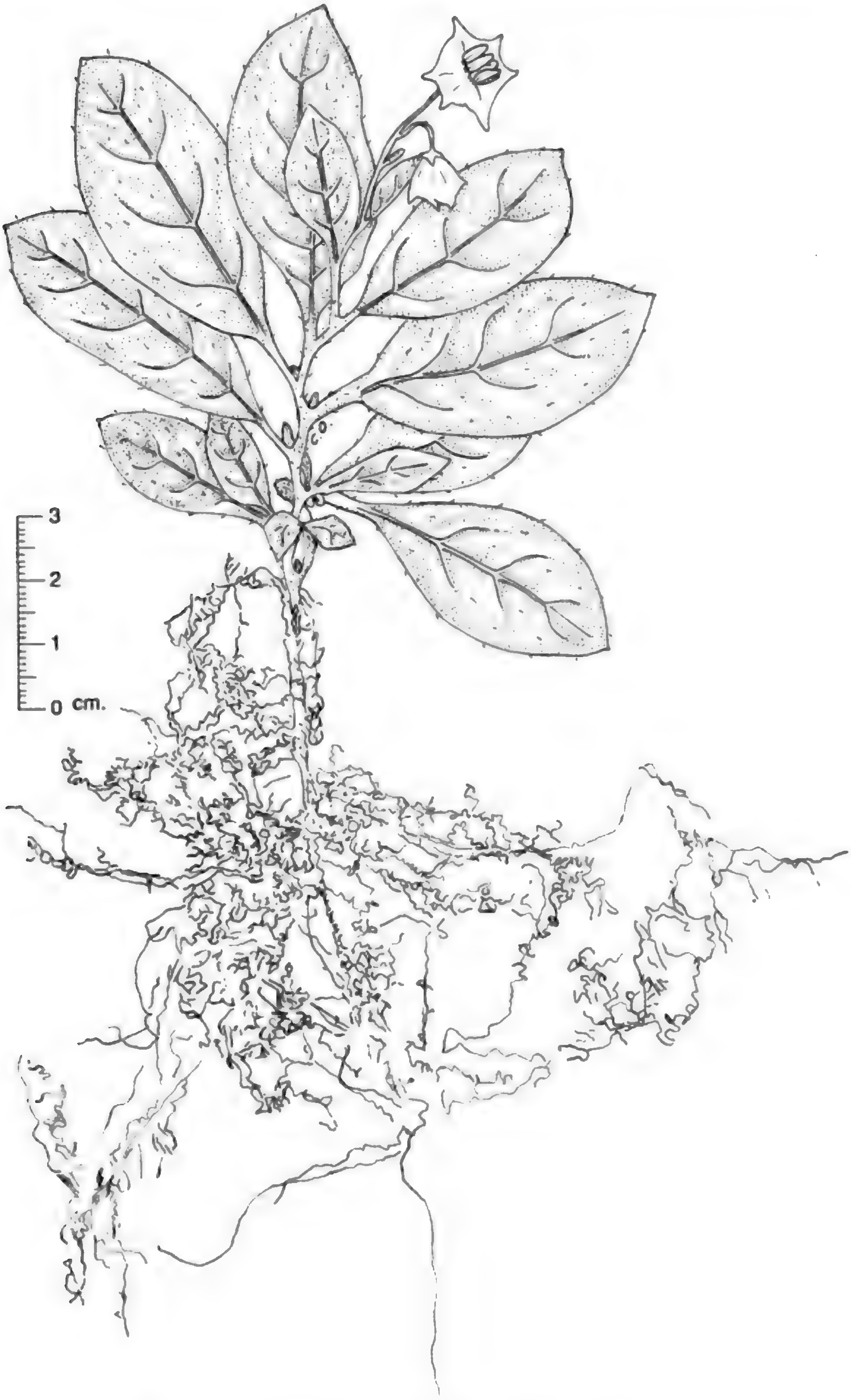
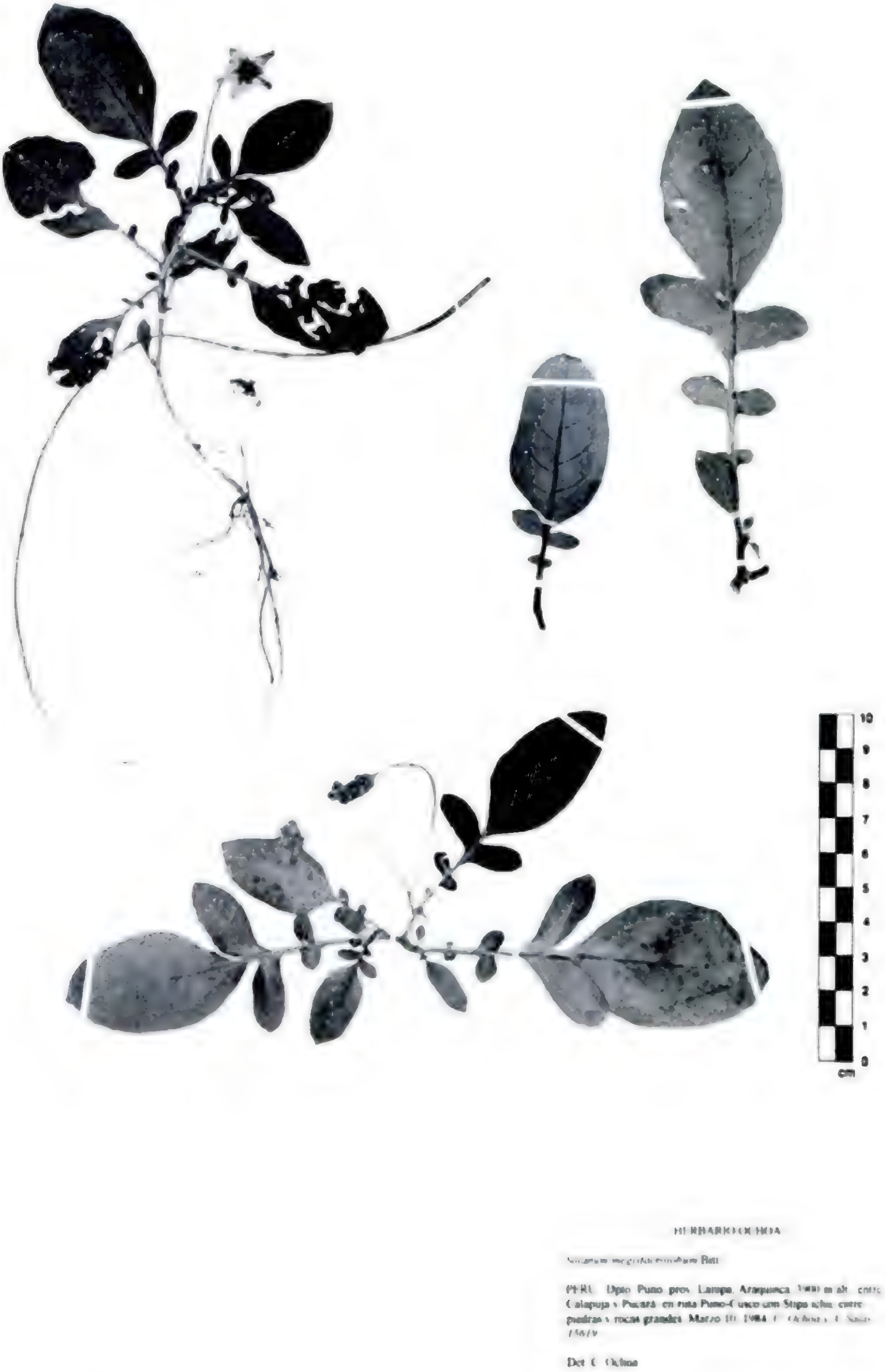


Figure 135. *Solanum megistacrolobum* (Ortega-65).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HERBARIO OCHOA
PERU. Dpto. Puno, prov. Lampa, [illegible] m alt. entre
[illegible] en ruta Puno-Cusco con Stipa ichu, entre
piedras y rocas grandes. Marzo [illegible] 1984. [illegible]
Det. C. Ochoa

Figure 136. *Solanum megistacrolobum* (*Ochoa and Salas 15619*).

Type: BOLIVIA. Department Tarija, Province Avilés, Puna Patanca, 3700 m alt., 8 January 1904, *K. Fiebrig 2618 p.p.* (B destroyed; lectotype S *fide* Hawkes & Hjerting, 1989 p. 220; isotypes BM, F-fragment, G, GOET, HBG, LD; LL-fragment, M, NY, SI, U, W, Z).

Affinities

This species is closely related to *S. sogarandinum*. The two species are alike in having a rosette-like or weakly decumbent habit and leaves and leaflets that are very similar in shape. However, *S. sogarandinum* differs markedly from the present species in having a much more robust and floriferous inflorescence, a longer and more robust peduncle that is typically biforked, and a corolla that is essentially rotate.

The simple-leafed forms of *S. megistacrolobum* also show some relationship to *S. boliviense*, a species of the Bolivian Andes. But, dwarf forms of this species with imparipinnate leaves are more similar to the Argentine species *S. sancta-rosae*. Both have terminal leaflets that are very enlarged, lateral leaflets that are narrowly decurrent upon the rachis, and corollas that vary from rotate-pentagonal to substellate.

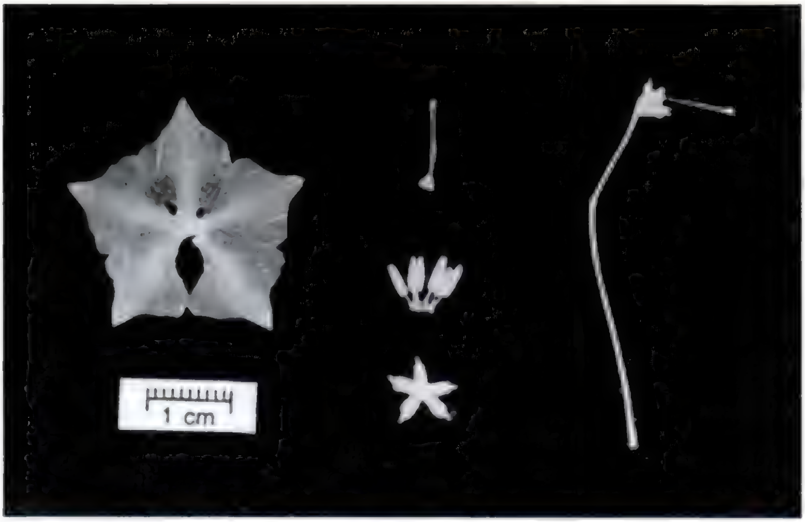


Figure 137. Floral dissection of *Solanum megistacrolobum* (*Ochoa 14269*).

Habitat and Distribution

This species belongs to the *puna* and *prepuna* formations of the central Andes of South America. Although the species is normally collected at elevations between 2700 and 4200 m, there are unsubstantiated reports of plants at even higher elevations (up to 4450 m).

Solanum megistacrolobum grows preferentially in high-altitude grasslands dominated by *Stipa ichu* and various species of the genera *Festuca* and *Calamagrostis*, as well as other native pasture grasses (Fig. 139), or occasionally with woody species of the genera *Chuquiraga* or *Lupinus*, or with the tuberous species *S. acaule*. Frequently, this species grows in thin or poor soils among rocks or in rock crevices (Fig. 138). It is also known from the margins of cultivated fields of quinoa (*Chenopodium quinoa*), barley (*Hordeum vulgare*) and tarwi (*Lupinus mutabilis*), as well as near fields of various Andean tuber crops, such as potato, oka (*Oxalis tuberosa*) and olluco (*Ullucus tuberosus*).

Correll (1962), who was the first to note the presence of *S. megistacrolobum* in Peru, records that it grows in the departments of Puno and Cusco. But because of the many additional specimens of *S. megistacrolobum* that have accumulated in the world's herbaria since his time, its distribution today is much more accu-

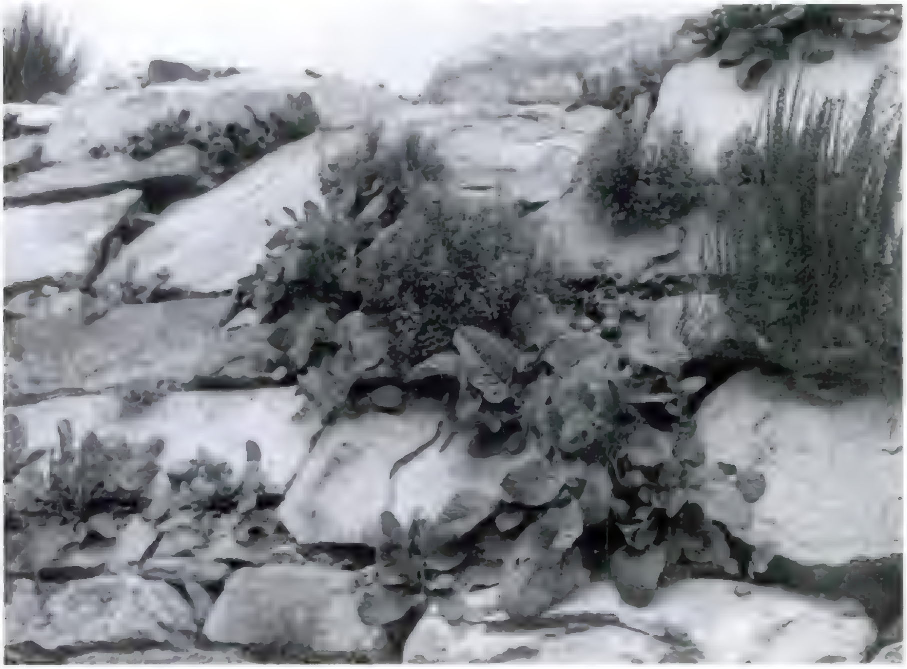


Figure 138. Habitat of *Solanum megistacrolobum* near Puno (4000 m alt.).

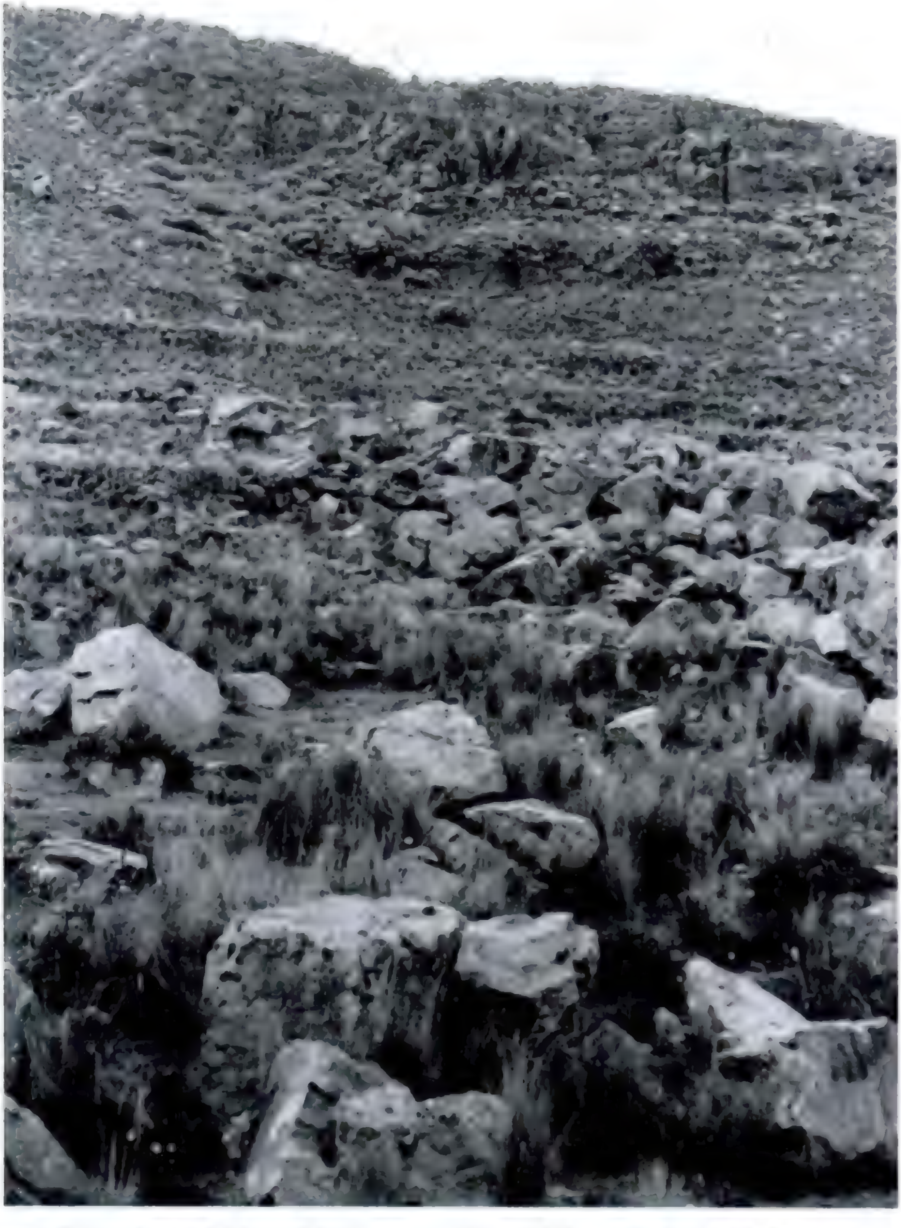


Figure 139. Habitat of *Solanum megistacrolobum* (*Ochoa 15619*) near Calapuya (3700 m alt.), Puno.

rately known. Thus, aside from its occurrence in Puno and Cusco, this species is also known from the departments of Ayacucho, Apurímac and Arequipa. The department of Cusco, however, still remains as its primary area of distribution. In Peru, this species commonly grows at elevations between 3500 and 3800 m. Individual plants of this species, however, have been collected at altitudes of 2900 m (Pumahuanca quebrada, province Urubamba, department Cusco) and 4220 m (near Utupara, province Cailloma, department Arequipa, Map 14). Additional information about this species, including its crossability and natural hybrids, can be found in monographs by Hawkes & Hjerting (1989, p. 216-236) and Ochoa (1990, p. 156-170).

Specimens Examined

Department Apurímac

Province Antabamba: Huanchojlla, 3440 m alt., near Totora on the Ttotora-Mamara road, among rocks and an *Agave* sp., 6 March 1980, C. *Ochoa 13732*, 2n=24 (CIP, MOL, OCH, USM).

Department Arequipa

Province Cailloma: Upper end of Utupara quebrada, 4220 m alt., *puna* above Chacramayo, west of Pulpera, 29 March 1974, C. *Ochoa 5090* (MOL, OCH, USM) and *5091* (MOL, OCH). Vicinity of Pulpera, 4100 m alt., in *puna*, 30 March 1974, C. *Ochoa 5105* (OCH). Utupara quebrada, 3800-3900 m alt., about 5 km west of Pulpera, in grassland of *Stipa ichu*, flowers violet, pentagonal, growing near *S. acaule*, 6 March 1981, C. *Ochoa 14269*, 2n=24, and *14272*, 2n=24 (CIP, OCH).

Department Cusco

Province Acomayo: Vicinity of the Pomacanchis cemetery, 3735 m alt., 6 April 1975, C. *Ochoa 7609* (OCH) and *7615* (CIP, OCH). Cerro Ccayahua Pucara, 3750 m alt., northeast of Pomacanchis, April 1975, C. *Ochoa 7616* (OCH). Conchacalla, 3700 m alt., District Pomacanchis, n.v. *Alkko-papa*, among *Stipa* sp. and *Chuquiraga* sp., near cultivated fields of tarwi (*Lupinus mutabilis*), potatoes and maize, February 1982, *R. Ortega 063* (OCH). Cerro Cruzpata, 4000 m alt., near Conchacalla, Distr. Pomacanchis, among *Stipa* sp., February 1982, *R. Ortega 065* (OCH). Conchacalla, 3700 m alt., Distr. Pomacanchis, among cacti and *Stipa*, February 1982, *R. Ortega 066* (OCH).

Province Calca: Pisac, 18 March 1945, C. *Vargas C. s.n.* (OCH). About 2 km west of Calca, 2975 m alt. (km 56 on the Calca-Urubamba road), base of cliff in rocky soil, 17 March 1963, *D. and V. Ugent 4461* (WIS).

Province Canas: Yanahuara, ca. 3800 m alt., 1 km from Tungasuca, among native grasses, beneath a large rock, 10 April 1986, *D. Rabinowitz and D. Begazo 392* (OCH).

Province Canchis: Environs of Sicuani, 3550 m alt., March 1946, *C. Vargas C. 5920* (CUZ, LL). Jururo, 3700 m alt., above the chapel of Cerro Calvario, facing the principal plaza of Sicuani (eastern side), very scarce, 12 March 1981, *C. Ochoa 14300* (OCH).

Province Cusco: Ruins of Sakksayhuamán, Inca fortress, above Cusco, ca. 3500 m alt. (13°31' S; 71°58' W), growing at the very base of walls or large boulders in full sun, 15 February 1963, *D. and V. Ugent 3592* (WIS). Fortress Pucara, 3550 m alt., Inca ruin, 7 km north-northeast of Cusco, on Cusco-Pisac road, growing in rocky soil on top of a wall, 27 February 1963, *D. and V. Ugent 3956-8* (WIS). Stone quarry near Grupo Arqueológico, 4.5 km north of Cusco (on Cusco-Pisac road) and 0.64 km east on turnoff to the ruins (about midway between the ruins of Sakksayhuamán and Tambomachay), 3600 m alt., 6 March 1963, *D. and V. Ugent 4124* (WIS). Stone quarry near Grupo Arqueológico, 4.5 km north of Cusco (on the Cusco-Pisac road) and 0.64 km east on turnoff to the ruins (about midway between the ruins of Sakksayhuamán and Tambomachay), 3600 m alt., 11-16 March 1963, *D. and V. Ugent 4267* and *4436* (WIS).

Province Quispicanchis: On open rocky slope, Piquillacta, Quispicanchis, 3200 m alt., flowers purplish, 1 March 1958, *D.S. Correll, E.E. Smith and C. Vargas C. P237 p.p.* (LL). Piquillacta, 3200 m alt., Inca wall near Oropesa, amid ruins and on surrounding rocky hillsides, with *S. raphanifolium* and *S. canasense*, 2 March 1963, *D. and V. Ugent 4045* (WIS) and *4048* (OCH).

Province Urubamba: Middle to upper part of Pumahuanca quebrada, northwest of Urubamba, 3400-3500 m alt., 15 February 1960, *C. Ochoa 2185* (OCH). Lower end of Pumahuanca quebrada, 3200-3600 m alt. (13°12' S, 72°03' W), a deep side valley of Urubamba River, ca. 2-4 km northwest of Urubamba, very steep, rocky, calcareous, heavily grazed southwest-facing slopes with xerophytic scrub forest of spiny Solanaceae, *Puya sorense*, *Berberis boliviensis*, *Escallonia racemosa*, *Baccharis*, *Eupatorium* sp., *S. raphanifolium* and *S. canasense* on paths and under shrubs, 31 December 1962, *H.H. and C.M. Iltis, D. and V. Ugent 996* (WIS, 2 sheets) and *997 p.p.* (WIS). *Ibiden* 24 February 1963, *D. and V. Ugent 3947* (WIS) and *3950* (OCH). Pumahuanca quebrada, 2900 m alt., near Urubamba, 20-30 March 1983, *C. Ochoa 15105* (CIP, OCH).

Department Puno

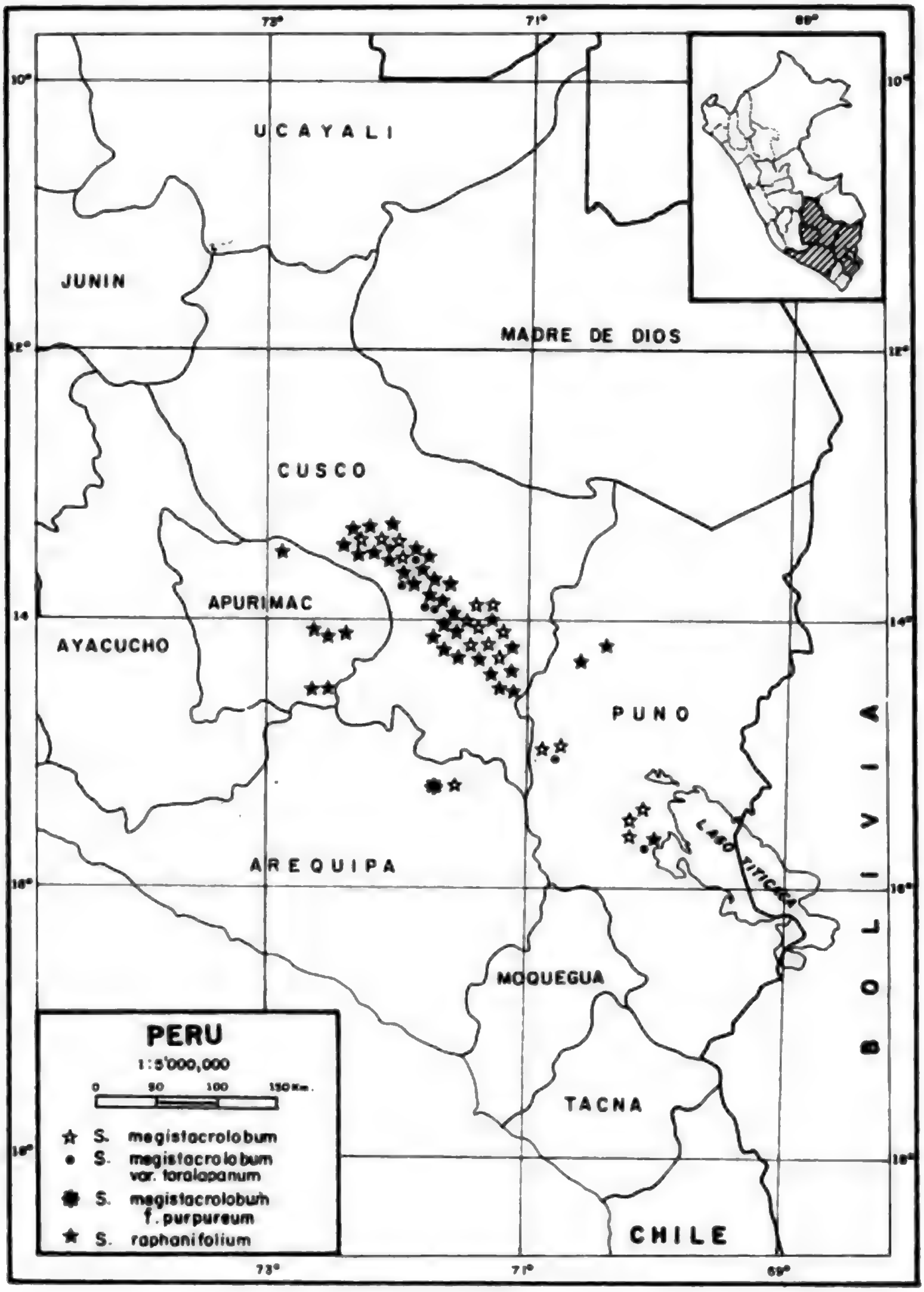
Province Chucuito: Collini, 3850 m alt., km 49 on the Puno-Ilave road, 16 February 1974, *Z. Huamán 736* (CIP, OCH).

Province Lampa: Araquinca, 3900 m alt., between Calapuja and Pucará, on the Puno-Cusco road, in *puna* grassland, amid stones and large rocks, 10 March 1984, *C. Ochoa* and *A. Salas 15619* (CIP, GH, MO, MOL, OCH, US, USM) and *15620* (CIP, MO, MOL, OCH, US, USM). Muñani, 4150 m alt., between rocks, March 1949, *C. Vargas C. 8271 p.p.* (CUZ, LL).

Province Puno: On rocky hills just above Puno, 3700 m alt., flowers purple, stellate, fruits ellipsoid to ovoid, 22 February 1958, *D.S. Correll and E.E. Smith P193* (LL sheet 1, NY, and LL sheet 2, US). On rocky hills just above Puno, 3700 m alt., plants with more dissected leaves than *P193*, fruits orbicular, 22 February 1958, *D.S. Correll and E.E. Smith P194* (F, LL sheet 1, LL sheet 2, US). Among rocks on mountain slopes, Camacani, 27 km southeast of Puno, 4100 m alt., plants low, flowers reddish purple, tubers about 1 cm in diam., 23 February 1958, *D.S. Correll and E.E. Smith P213* (LL).

Breeding Potential

Solanum megistacrolobum and its var. *toralapanum*, although individually self-incompatible, are easily intercrossed. Reciprocal crosses involving *S. megistacrolobum* and *S. raphanifolium* from series Megistacroloba and *S. medians* from series Tuberosa (all 2n=24 and EBN=2) were successful in all cases, although the number of seeds obtained per berry, on the average, was relatively low. Similarly, only a small number of seeds were obtained in unilateral crosses of *S. megistacrolobum* from series Megistacroloba with species from series Tuberosa such as *S. sparsipilum*, *S. multiinterruptum*, *S. bukasovii* and *S. phureja* (all EBN=2). But no success was had at all in reciprocal crosses involving *S. megistacrolobum* and *S. dolichocremastrum* (EBN=1). On the other hand, crosses involving *S. megistacrolobum* (EBN=2) and *S. albicans* (EBN=4) were successful in yielding a few seeds, but only when the latter was used as the staminate parent. Lastly, some interesting results were obtained in crosses involving *S. megistacrolobum* (2n=24 and EBN=2) and *S. acaule* (2n=48 and EBN=2), but only when the latter was used as the pistillate parent. In this case, the progeny exhibited an unusual amount of F_1 segregation, this possibly as a result of their being triploid (see Table 33).



Map 14. Distribution of *S. megistacrolobum*, *S. megistacrolobum* var. *toralapanum*, *S. megistacrolobum* f. *purpureum* and *S. raphanifolium*.

Table 33. Fertility of *Solanum megistacrolobum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note following Table 1 for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	Megistacroloba	× *S. dolichocremastrum*	5(13)	5(5)	0(0)
24	2	Megistacroloba	× *S. raphanifolium*	39(16)	36(3)	36(15)
24	2	Tuberosa	× *S. bukasovii*	11	9	16
			× *S. bukasovii* f. *multidissectum*	7	7	0
			× *S. medians* var. *autumnale*-2x	3(8)	3(8)	17(22)
			× *S. multiinterruptum*	3	1	18
			× *S. phureja*	1	1	20
			× *S. sparsipilum*	4	4	20
48	2	Acaulia	× *S. acaule*	3(19)	2(18)	0(71)
72	4	Acaulia	× *S. albicans*	5(6)	5(3)	7(0)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 34. Collections (OCH) used in *Solanum megistacrolobum* fertility studies.

ACAULIA
S. acaule 8611, 9012, 11899A, 11983, 11990
S. albicans 12091, 13014

MEGISTACROLOBA
S. dolichocremastrum 13013
S. megistacrolobum 11987, 14272, 15619, 15620
S. raphanifolium 7610, 13577, 13704, 13735, 13775, 14296, 14318, 14346

TUBEROSA
S. bukasovii 9795, 13858, 14333, 14372, 14383
S. bukasovii f. *multidissectum* 13720
S. medians-2x 11311
S. multiinterruptum 14718
S. phureja 14460
S. sparsipilum 8385, 11893, 12030, 12038, 13564

29a. *Solanum megistacrolobum* Bitt. var. ***toralapanum*** (Cárd. et Hawkes) Ochoa, *The Potatoes of South America*: *Bolivia*, 171, 181, Figs. 71 to 76, Plate XII, Cambridge, UK, 1990. Figs. 140-142; Map 14.

S. decurrentilobum Cárd. et Hawkes, J. Linn. Soc. Bot. 53:97-98, Fig. 3, 1946. Type: *M. Cárdenas 3503,* BOLIVIA. Department Cochabamba, Province Arani, near Tiraque, Hacienda Toralapa, February 1944 (CPC).

S. toralapanum Cárd. et Hawkes, J. Linn. Soc. Bot. 53:98-99, Fig. 4, 1946. Type: *M. Cárdenas 3504*, BOLIVIA. Department Cochabamba, Province Arani, Tiraque, Hacienda Toralapa, February 1944 (CPC).

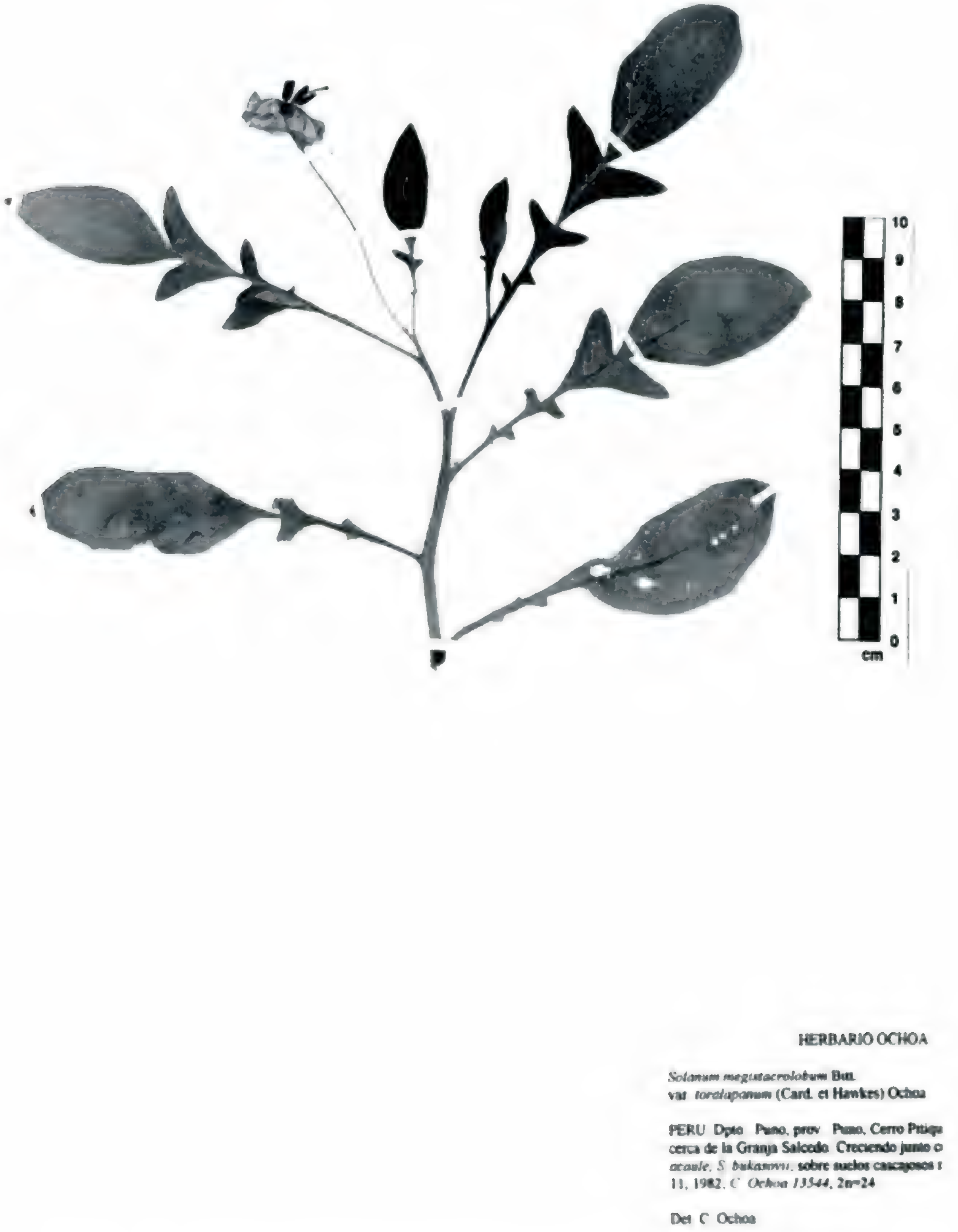
S. toralapanum var. *subintegrifolium* Cárd. et Hawkes, J. Linn. Soc. Bot. 53:99-100, Fig. 5, 1946. Type: *M. Cárdenas 3505 p.p.,* BOLIVIA. Department Cochabamba, Province Arani, Tiraque, Hacienda Toralapa, February 1944 (CPC).

S. ellipsifolium Cárd. et Hawkes, J. Linn. Soc. Bot. 53:100-101, Fig. 6, 1946. Type: *M. Cárdenas 3505 p.p.*, BOLIVIA. Department Cochabamba, Province Arani, Tiraque, Hacienda Toralapa, February 1944 (CPC).

S. ureyi Cárd., Bol. Soc. Peruana Bot. 5(1-3):32-33, Fig. 1, Plate III-B, Plate IV-D, 1956. Type: *Cárdenas 3262,* BOLIVIA. Department Cochabamba, Province Ayopaya, Hacienda Sailapata, November 1936, (holotype Herbarium Cárdenas, Bolivia, isotype US).

S. megistacrolobum subsp. *toralapanum* Giannattasio & Spooner, Syst. Bot. 19(1):89-105 and 106-115, 1994.

Plant rosette-forming or shortly caulescent, simple or with extending or erect-ascending branches, generally densely and coarsely pilose; hairs simple, multicellular, mixed with shorter, tetralobular glandular hairs that impart a disagreeable odor. Leaves (3-)6-15(-25) cm long, simple or irregularly imparipinnate to imparipinnatisect or imparipinnatifid, with 1-3(-4) pairs of lateral leaflets. Terminal leaflet, or blade in the case of simple leaves, (2.5-)5.0-9.0(-16.0) cm long by (1.5-)3.5-4.5(-6.5) cm broad, elliptic to oblanceolate, broadly rounded to ovate-suborbicular or long-curved spatulate; apex occasionally apiculate; lateral leaflets much smaller than the terminal, (2.5-)3.5-5.0 cm long, obliquely ovate-triangular, apex obtuse, base sessile, conspicuously and broadly triangularly-decurrent about the rachis on the basiscopic side. Inflorescence cymose, 1-5(-9)-flowered. Peduncle 7-9 cm long, densely pilose; pedicels 10-30 mm long, densely pilose, articulated 5-7 mm below the base of the densely pilose calyx. Corolla usually rotate, with short acumens or occasionally rotate-pentagonal, purple to dark violet or lilac, 2.5-3.0(-3.5) cm in diam. (Fig. 142). Fruit round to ovoid. Chromosome number 2n=24. EBN=2.



HERBARIO OCHOA

Solanum megistacrolobum Bitt.
var. *toralapanum* (Card. et Hawkes) Ochoa

PERU Dpto Puno, prov Puno, Cerro Pitiqu
cerca de la Granja Salcedo. Creciendo junto c
acaule, *S. bukasovii*, sobre suelos cascajosos s
11, 1982. *C. Ochoa 13544*, 2n=24

Det. C. Ochoa

Figure 140. *Solanum megistacrolobum* var. *toralapanum* (*Ochoa 13544*).

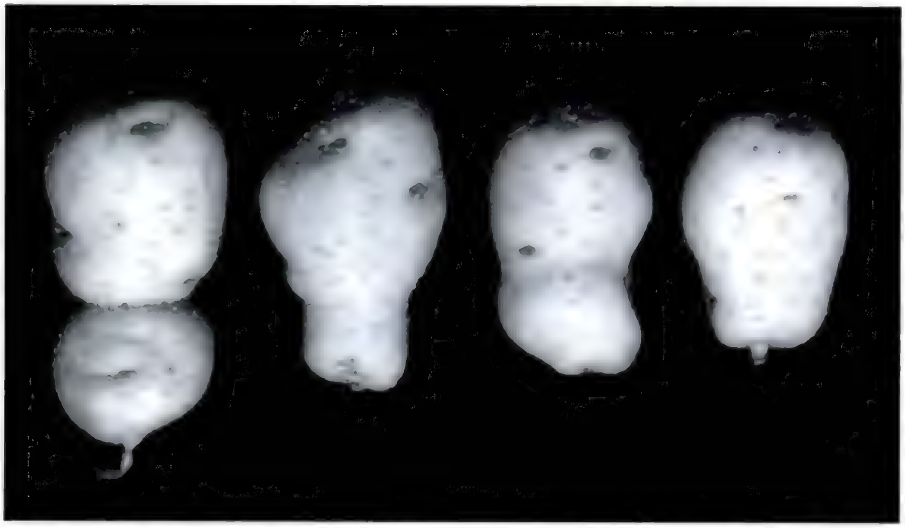


Figure 141. Tubers of *Solanum megistacrolobum* var. *toralapanum* (*Ochoa 13544*).

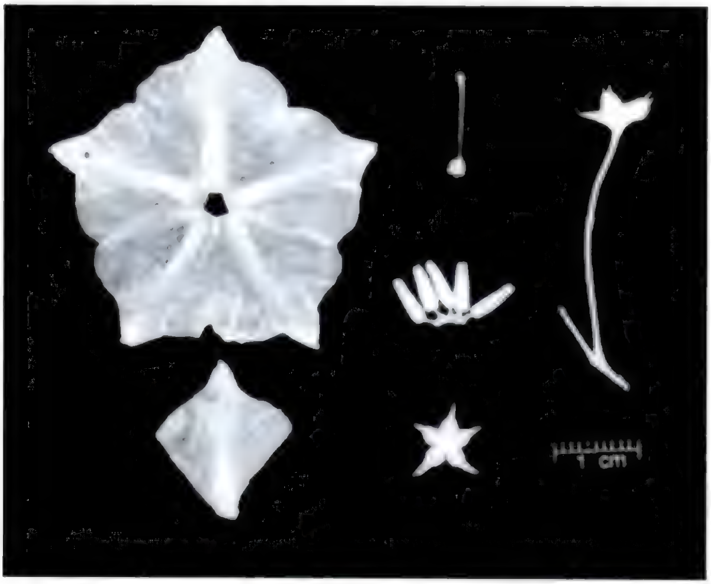


Figure 142. Floral dissection of *Solanum megistacrolobum* var. *toralapanum* (*Ortega 049*).

Type: BOLIVIA, Department Cochabamba, Province Arani, near Tiraque, Hacienda Toralapa, 3700 m alt., February 1944, *M. Cárdenas 3504* (holotype CPC).

Habitat and Distribution

Variety *toralapanum* of *S. megistacrolobum* grows in habitats similar to those described for the typical variety of this species. Although this species is most commonly encountered in the Bolivian Andes, its range extends from the departments of Cusco and Puno in southern Peru to the province of Salta in northwestern Argentina (Correll, 1962; Ochoa, 1990). Its altitudinal limits in Peru vary from 3300 m to 4100 m (Map 14).

Specimens Examined

Department Cusco

Province Acomayo: Cerro Jocohuachana, 4100 m alt., Distr. Pomacanchi, amid *Stipa ichu* and *Puya*, February 1982, *R. Ortega 043* (OCH). Conchacalla-Jatunpujio, 3700 m alt., Distr. Pomacanchi, amid *Pennisetum clandestinum* and *Urtica*, February 1982, *R. Ortega 049*, 2n=24 (OCH).

Province Calca: Ruins of Intihuatana, 24 April 1953, *C. Ochoa 2063*, 2n=24 (OCH).

Province Cusco: About 4 km from Cusco on road to Pisac, 3650 m alt., plants low with purple stems and rachis of leaves, flowers purple, 26 February 1958, *D.S. Correll and E.E. Smith P222* (LL).

Province Urubamba: Between San Juan and Cuyoc, highlands of Yucay, 3300 m alt., in a thicket of *Barnadesia* and *Buddleja* with an understory of grasses, berries round, green with white dots, 18 March 1980, *C. Ochoa 13776* (CIP, OCH).

Department Puno

Province Puno: Cerro Pitiquillani, 3850 m alt., near Granja Salcedo, growing with *Stipa* sp., *S. acaule* and *S. bukasovii*, on very poor gravelly soils, 11 January 1982, *C. Ochoa 13544*, 2n=24 (CIP, MOL, OCH, from plants grown at Huancayo). Near Puno, 4000 m alt., *J. Soukup 263* (F).

Breeding Potential

No seeds were obtained in reciprocal crosses of *S. megistacrolobum* var. *toralapanum* (2n=24, EBN=2) with *S. immite* (2n=24, EBN=1), and only a modest number was generated from the unilateral crosses of this plant with *S. circaeifolium* var. *capsicibaccatum* (2n=24, EBN=1). Moreover, all unilateral crosses with *S. candolleanum* and *S. infundibuliforme* (both 2n=24 and EBN=2) ended in failure. However, ample seed was obtained in reciprocal crosses involving *S. sogarandinum*, *S. bukasovii* and *S. bukasovii* f. *multidissectum* (all 2n=24 and EBN=2), as well as in reciprocal crosses involving *S. raphanifolium*, *S. sparsipilum* and *S. limbaniense* (all 2n=24 and EBN=2), but only when the latter three species were used as the staminate parents. In fact, the highest seed set of all came from flowers that were dusted with the pollen of *S. megistacrolobum* var. *toralapanum*. Other successful or partially successful reciprocal crosses involved the species *S. acaule* (2n=48, EBN=2) and *S. albicans* (2n=72, EBN=4). In the case of *S. albicans*, a fair number of seeds resulted even though the EBN values of the two species that were crossed were quite different (this shown again in the direct crosses of this variety with the cultivated species, *S. tuberosum* subsp. *andigena*; 2n=48, EBN=4) (see Table 35).

Table 35. Fertility of *Solanum megistacrolobum* var. *toralapanum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note following Table 1 for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	Circaeifolia	× *S. circaeifolium* var. *capsicibaccatum*	11	2	33
24	1	Tuberosa	× *S. immite*	5(8)	0(0)	0(0)
24	2	Conicibaccata	× *S. chomatophilum*	1(5)	1(2)	18(7)
			× *S. limbaniense*	6(11	4(7)	17(0)
24	2	Cuneoalata	× *S. infundibuliforme*	4	4	0
24	2	Megistacroloba	× *S. raphanifolium*	13(10)	8(0)	106(0)
			× *S. sogarandinum*	2(11)	2(7)	50(81)
24	2	Tuberosa	× *S. bukasovii*	61(64)	37(40)	19(62)
			× *S. bukasovii* f. *multidissectum*	15(22)	8(13)	10(13)
			× *S. candolleanum*	7	6	0
			× *S. coelestispetalum*	1	1	5
			× *S. sparsipilum*	4(0)	3(0)	67(0)
48	2	Acaulia	× *S. acaule*	28(45)	21(42)	67(75)
48	4	Tuberosa	× *S. tuberosum* subsp. *andigena*	3	2	30
72	4	Acaulia	× *S. albicans*	2(1)	2(1)	30(0)
36	?	Yungasensa	× *S. yungasense*-3x	6	2	5

FL = total number flowers pollinated, TB = total number berries obtained, SB = average number seeds per berry.

Table 36. Collections (OCH) used in *Solanum megistacrolobum* var. *toralapanum* fertility studies.

ACAULIA
S. acaule 10112, 11862, 11899A, 11961, 11983, 11990
S. albicans 12090, 13238

CIRCAEIFOLIA
S. circaeifolium var. *capsicibaccatum* OCH s.n. (=WIS 1730)

CONICIBACCATA
S. chomatophilum 11858, 14787
S. limbaniense 14288

CUNEOALATA
S. infundibuliforme 11977

MEGISTACROLOBA
S. megistacrolobum var. *toralapanum* 11914, 11916, 11960, 11962, 11963, 11964, 12098, 13544
S. raphanifolium 7573, 7610, 13610A, 13775, 14299
S. sogarandinum 13324, 13336

TUBEROSA
S. bukasovii 7726, 8693, 9928, 11058, 11300, 11306, 11330, 11861, 11870, 11873, 11874, 12043, 13106, 13125, 13195, 15202
S. bukasovii f. *multidissectum* 11843, 11868, 13110
S. candolleanum 11805
S. coelestispetalum 7728
S. immite 15184
S. phureja 5443
S. sparsipilum 8358, 11893, 12028, 12030
S. tuberosum subsp. *andigena* 13127

YUNGASENSA
S. yungasense-3x 14842

29b. ***Solanum megistacrolobum*** Bitt. f. ***purpureum*** Ochoa, Phytologia 77(5):390-392. Fig. 143; Map 14.

Forma *purpureum* of *S. megistacrolobum* differs from the typical plant in having a longer pedicel that is articulated 10-12 mm below the calyx and very different appearing tubers. These are generally 3-4 cm long and subcylindrical or elongated, with a broadly obtuse apex, fusiform base and a brilliantly colored purple periderm. The berries of this rosette-forming plant with imparipinnatisect leaves are round, light green, and densely white punctate, but not verrucose.

Type: PERU. Department Arequipa, Province Cailloma, lower foothills of Cerro Yahuarmayo, 4000 m alt., *puna*, 6 March 1981, C. *Ochoa 14273* (holotype OCH, isotypes CIP, MOL, USM).

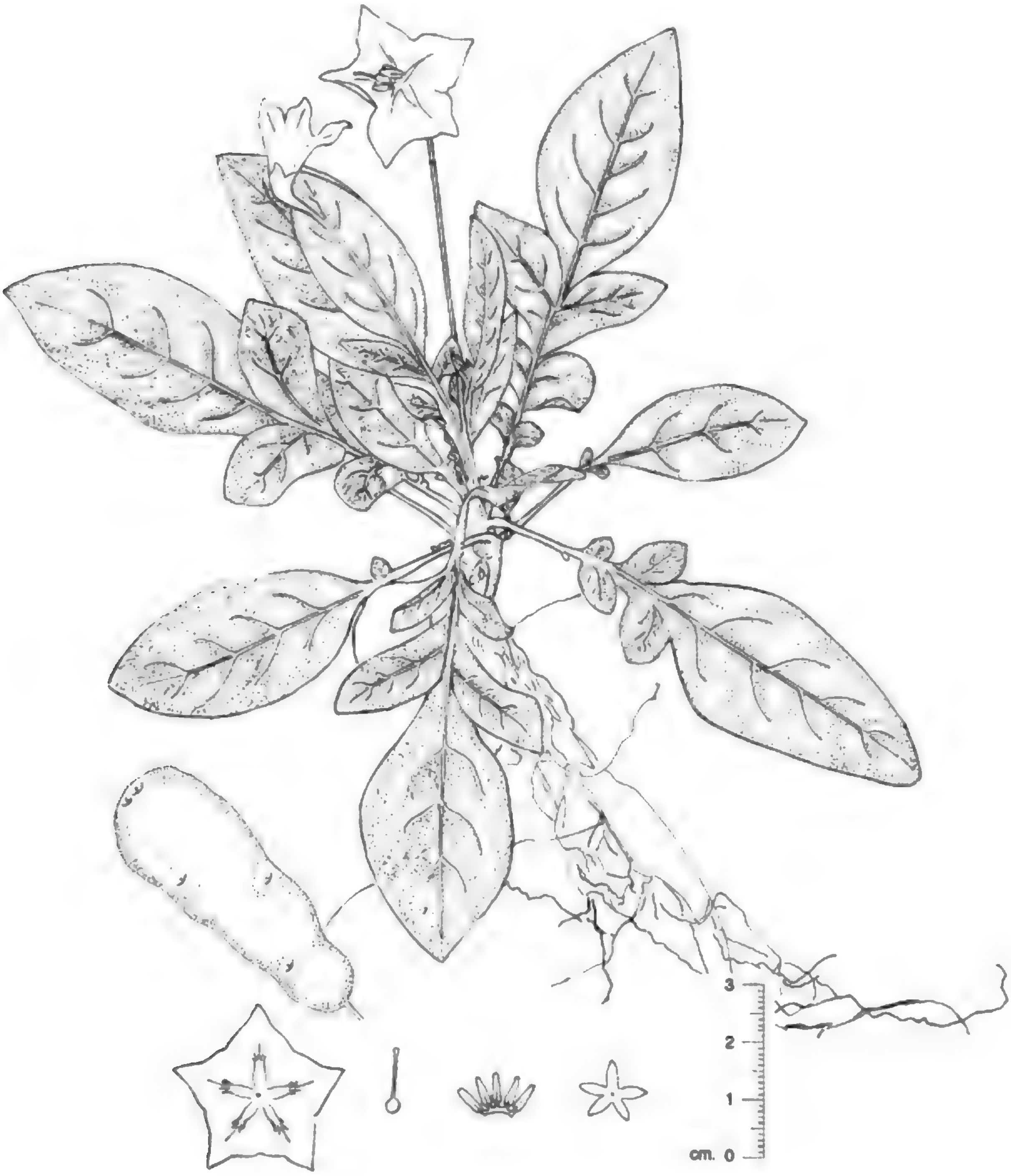


Figure 143. *Solanum megistacrolobum* f. *purpureum* (*Ochoa 14273*).

Specimens Examined

Department Arequipa

Province Cailloma: Lower foothills of Cerro Yahuarmayo, 4000 m alt., *puna* facing Pulpera, growing near *S. acaule*, among tufts of grass, 6 March 1981, C. *Ochoa 14273* (holotype OCH, isotypes CIP, MOL, USM).

30. *Solanum raphanifolium* Cárd. et Hawk., J. Linn. Soc. Bot. 53:94-95, Fig. 1, 1946.

Figs. 144-152; Map 14.

S. hawkesii Cárd., J. Linn. Soc. Bot. 53:95-97, Fig. 2, 1946. Type: *M. Cárdenas 3506*, PERU. Department Cusco, Machu Pikchu (CPC, CUZ).

Plant (10-)20-30(-40) cm tall, rosette-forming or semirosette-forming, extended or somewhat elongated, varying from branching-decumbent to erect-ascending, sparsely pilose. Stem simple or branched; internodes short, appearing to be nearly lacking in dwarf plants or 2-4(-7) cm long in better-developed individuals; plant stoloniferous and tuber-bearing, stolons to 1.5 m or more long; tubers round to ovoid, (1-)2-3 cm long, white or rarely whitish-violet (Fig. 150). Leaves (2.0-)4.5-15.0(-20.0) cm long by (1.5-)2.0-7.0(-9.0) cm wide, dark green and sparsely and coarsely pilose above, grayish green and more densely and finely pilose below. Leaves usually imparipinnate, more rarely simple, with (0-)2-4(-5) pairs of leaflets, with or without interjected leaflets; terminal leaflet larger or much larger than the laterals, (1.5-)5.0-9.0(-12.0) cm long by (1-)3-5(-8) cm wide, broadly elliptic or broadly ovate to obovate, apex broadly rounded and apiculate; base cuneate, symmetrical or asymmetrical; lateral leaflets ovate to obovate, sessile or somewhat decurrent about the rachis, apex rounded to slightly pointed or apiculate; the first upper pair of leaflets (0.5-)3.0-5.0(-8.0) cm long by (0.2-)1.5-3.0(-4.0) cm wide, the base conspicuously decurrent about the rachis. Pseudostipular leaves obliquely elliptic, falcate, small, 5-7 mm long. Inflorescence terminal or lateral, cymose to cymose-paniculate, 1-8(-12)-flowered. Peduncle (2.5-)9.0-14.0 cm long, simple or biforked, sparsely pilose and somewhat glandular; pedicels (15-)25-35 mm long, shortly and sparsely pilose and slightly pigmented; pedicels articulated 5-9 mm below the base of the calyx. Calyx symmetrical or asymmetrical, 6-7 mm long, slightly pigmented; lobes ovate to ovate-lanceolate, abruptly narrowed to the apex; acumens short and pointed, 1.0-1.5 mm long, with membranous margins. Corolla deep purple or violet, rotate-pentagonal to pentagonal, (2.5-)3.0-3.5 cm in diam. (Fig. 148), the lobes not always well delimited from the acumens. Anthers lanceolate, 5-6 mm long; filaments 1.0-1.5 mm long, glabrous. Style 7.5-9.0 mm long, exserted 2-3 mm, sparsely papillose below center; stigma capitate. Fruit 1.5-2.0 cm long, round to subovoid, uniformly light green or occasionally marked with small white dots (see Fig. 149). Chromosome number 2n=24. EBN=2.

Local names: *K'kita Papa* (= Wild Potato) in the province and department of Cusco; *Jampatu Papa* (= Toad Potato) in Urubamba, department Cusco; and *Arakk-papa* in the Vilcanota Valley, Cusco.

Type: PERU. Department and Province Cusco, Sakksayhuamán Fortress, near Cusco, March 1943, *M. Cárdenas and H. Gandarillas 3500* (holotype K *fide* Hawkes, 1990, p. 102) and *3501* (isotype CPC).

The majority of the collections of *S. raphanifolium* that I examined were of caulescent plants. Typically, these have a decumbent or erect-decumbent unbranched stem that normally bears divided leaves. However, it is not uncommon

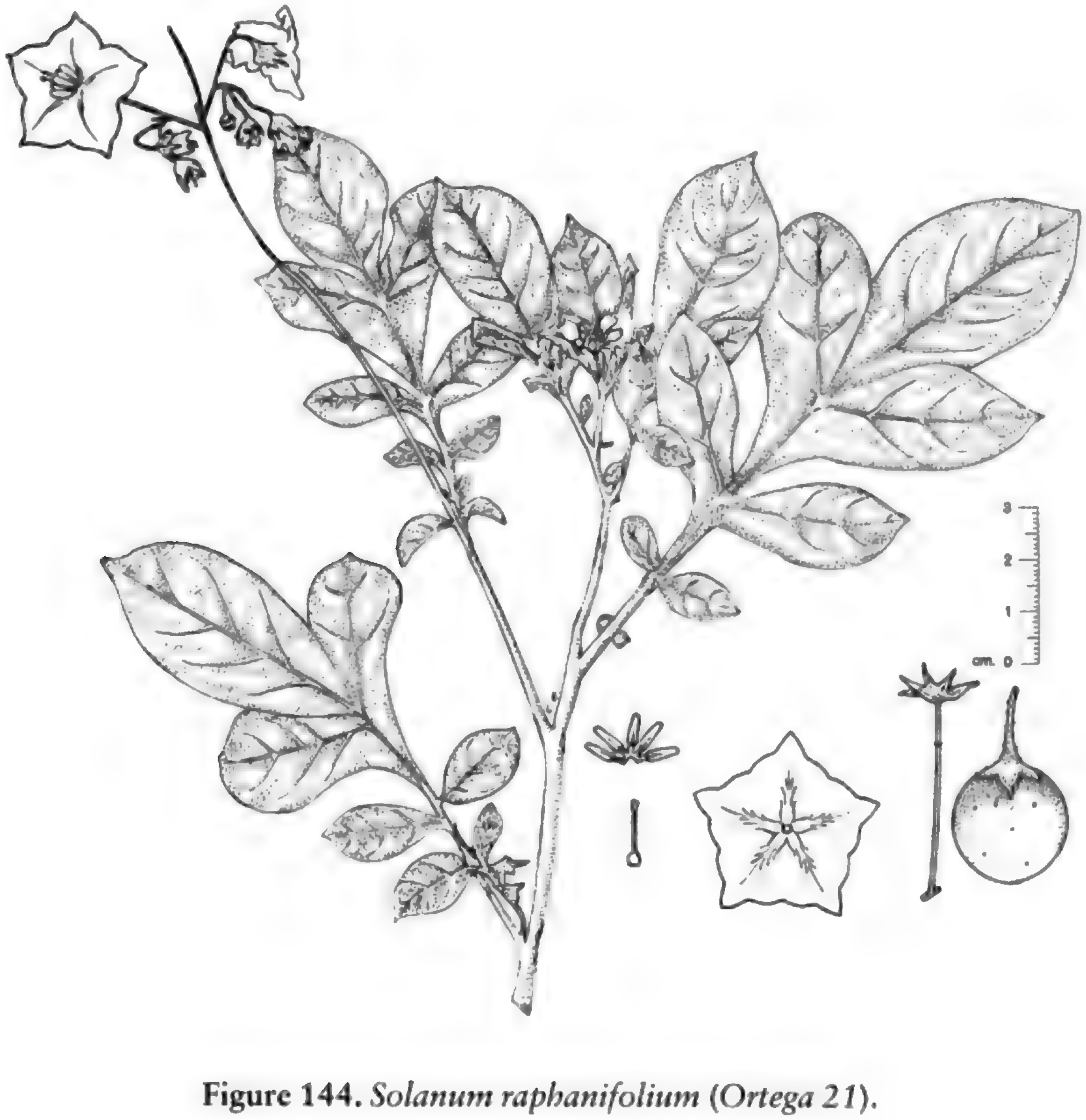


Figure 144. *Solanum raphanifolium* (*Ortega 21*).

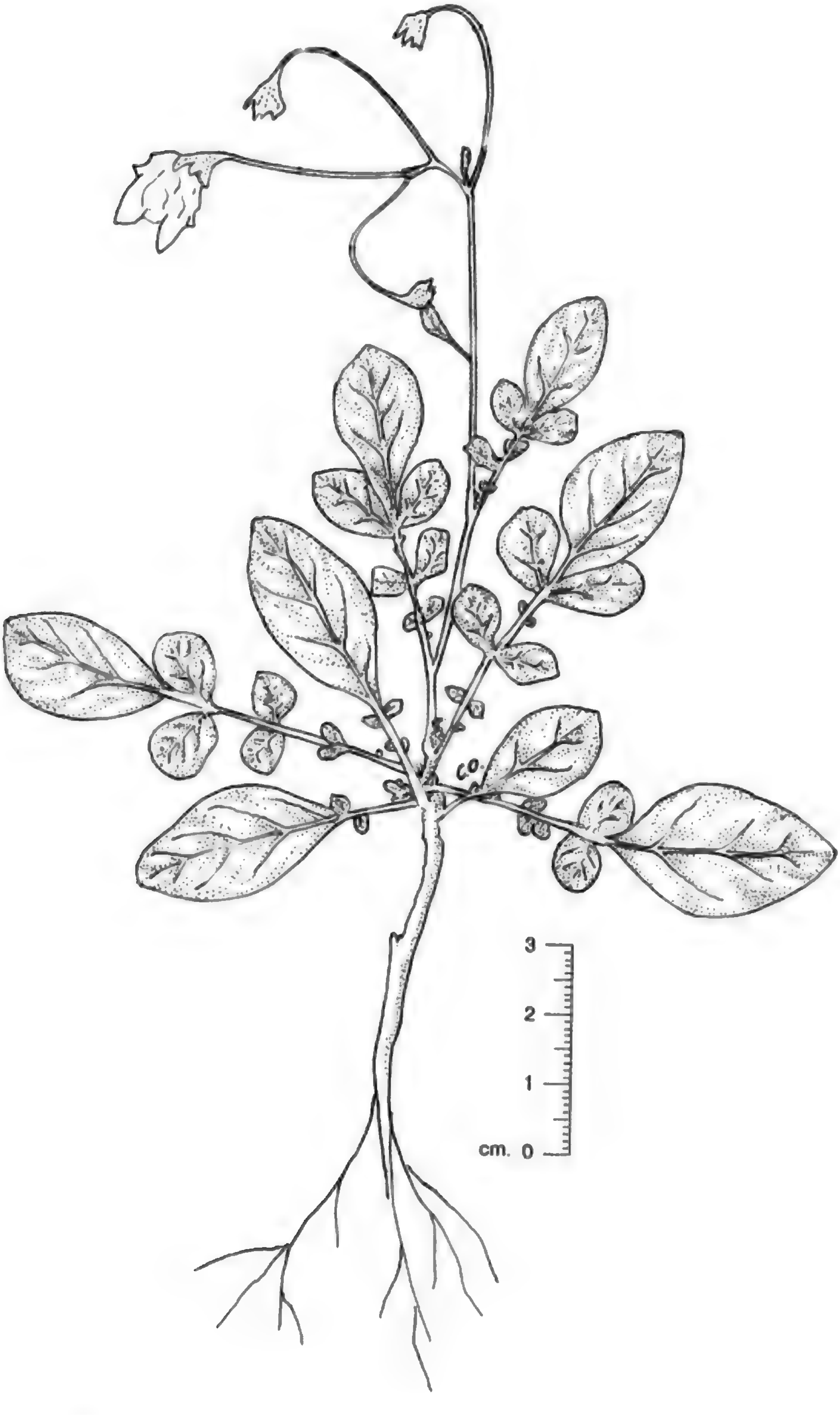


Figure 145. *Solanum raphanifolium* (*Ugent 3552*, topotype).

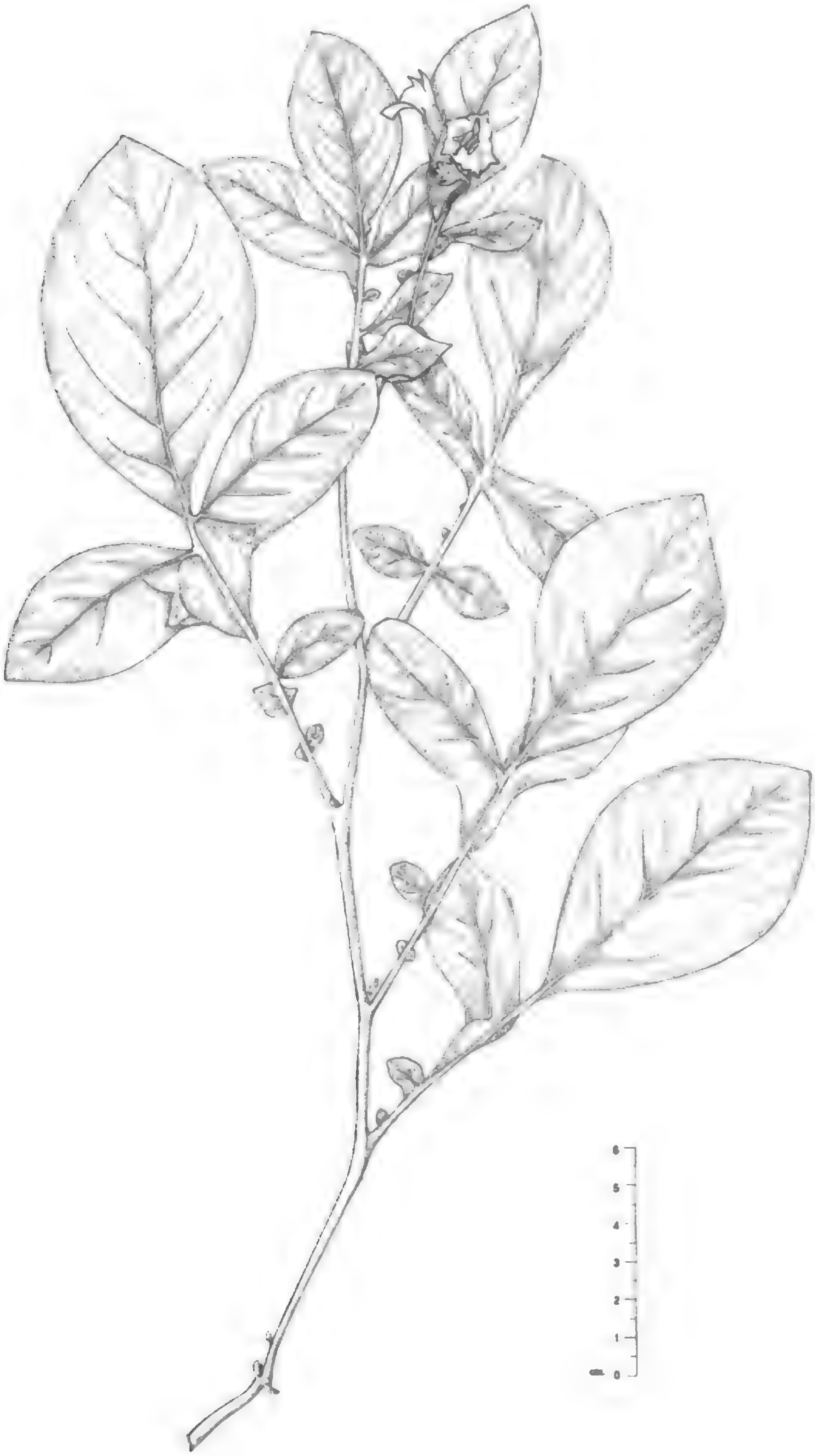


Figure 146. *Solanum raphanifolium* (*Cárdenas 3506*, type collection of "*S. hawkesii*").

in this species for simple leaves to occur at the base of the plant, or for pinnatisect ones that are only poorly dissected to occur on nodes that are only slightly higher up.

According to one hypothesis, *S. raphanifolium* is of fairly recent origin. Ugent (1970) considers this species to be a stabilized diploid hybrid derived from natural crosses between *S. megistacrolobum* and *S. canasense* (the latter treated here as a synonym of *S. bukasovii*). Artificial crosses that were made between these two species gave rise to plants in the F_2 populations that were very similar in their morphology to *S. raphanifolium*. Furthermore, Ugent notes that *S. raphanifolium* occurs in nature only in the relatively small area of southern Peru where the ranges of the two putative parental species meet and are sympatric. Moreover, unlike *S. megistacrolobum* and *S. canasense*, *S. raphanifolium* seems to prefer disturbed habitats (a common characteristic of hybridogenic species *fide* geneticist Edgar Anderson). Lastly, Ugent points out that forms very similar in appearance to *S. raphanifolium* are known to occur spontaneously in the naturally occurring hybrid swarms of *S. megistacrolobum* and *S. canasense* that form in the vicinity of Cusco, Peru.

More recently, Spooner et al. (1991) reexamined the origin of *S. raphanifolium* using molecular techniques based on cp DNA. Genetic distance, as calculated from the derived p values, was taken as the primary measure of relationship. Unfortunately, the accessions used for these experiments were not all taken from the department of Cusco, so it would be difficult to make any direct comparisons by using their results. Nevertheless, the particular clones of *S. megistacrolobum* and *S. canasense* that were assessed in the aforementioned study were said to be more closely related to one another than either one was to *S. raphanifolium*. Although this would appear at first glance to negate a hybridogenic origin for *S. raphanifolium*, a word of caution is again advisable, as the above experimenters failed to run a control test on their results by using artificially created hybrids of *S. megistacrolobum* and *S. canasense*. We can't be sure, therefore, that their methodology actually works.

While the origin of *S. raphanifolium* is a problem that is not easily resolvable here, it may be worth noting that stabilized hybrids have been traditionally treated by monographers as "good" taxonomic species. The reproductive constancy and fertility of such naturally occurring forms, coupled with their obviously different morphology, are all traits that the trained systematist learns to look for in the delimitation of "species" in the classical sense. For this reason, little or no future change is anticipated in the present treatment of *S. raphanifolium*.

The original diagnosis of *S. raphanifolium* was based on two collections by Cárdenas and Gandarillas (Nos. *3500* and *3501*), both from the vicinity of Cusco. Today, these two specimens constitute, respectively, the holotype (designated by

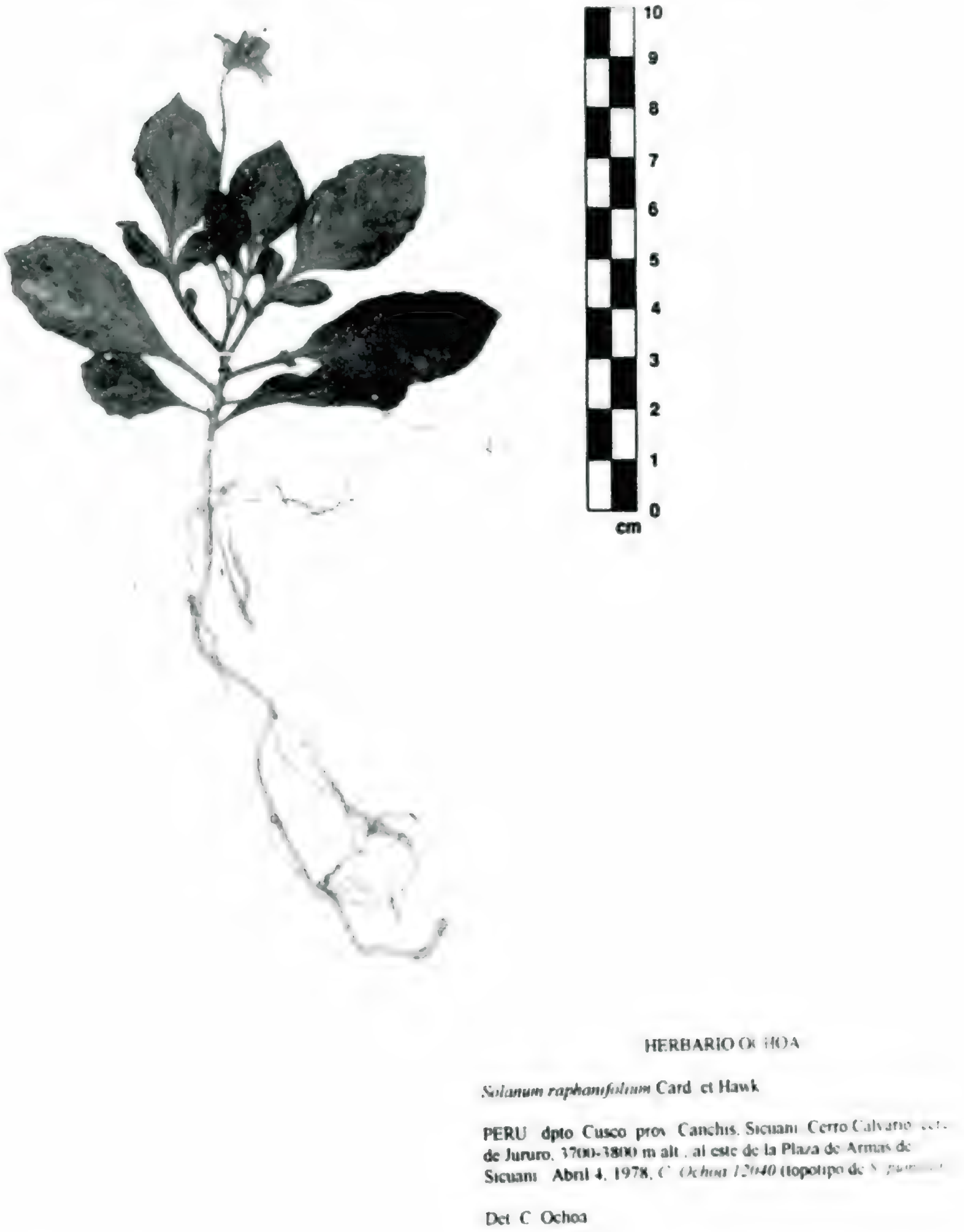
Hawkes in 1990, p. 102) and the paratype of this species. The holotype (No. *3500*) consists of a plant with an extended, caulescent stem bearing long, decumbent branches, whereas the paratype (No. *3501*) is a rosette-forming plant, and has only a very abbreviated stem. The two original authors of this species, however, indicated that the differences noted between these two plants are not of sufficient magnitude to warrant their separation into distinct species. Moreover, they believed that the observable differences were probably initially brought about by the growth of these plants under varying environmental conditions, such as might be caused by exposure to differing soil and light conditions.

It is evident that *S. raphanifolium* varies enormously in nature, especially in plant habit and leaf shape, features that are easily influenced by a variety of environmental factors such as the physical composition of the soil and its moisture content, altitude (as this affects temperature), light exposure and plant competition.

Knowledge of the extreme environmental plasticity of this species has been helpful in equating collections of "*S. hawkesii*" (*cf. Cárdenas 3506*) with *S. raphanifolium*, including specimens collected by Correll, Smith and Vargas (*P228, P230, P235, P237, P240*) and others, as well as modern-day topotypes. Similarly, recognition of this major source of variation in *S. raphanifolium* has been a determining factor in the identification of the seven small plants of this species that were originally collected by Correll and Smith (*cf. P219*), and later mounted on a single sheet in the U.S. National Herbarium. Likewise, the three Correll and Smith specimens (also numbered *P219*) that are mounted on a single sheet in the Lundell Herbarium (LL, Texas) are very similar to Nos. *3500* and *3501* of *S. raphanifolium*, collected by Cárdenas and Gandarillas in its type locality.

As mentioned earlier, many examples of dwarf plants, or rosette- or semirosette-forming plants, can be seen in original collections of this species, including *Vargas 4856* and *5519* (CUZ, OCH), *Ugent and Vargas 3529* (WIS), *Ugent 3810, 3811, 3812, 3816* and *4268* (WIS), *Ochoa 2176* and *13574* (OCH), and others.

As was the case with many other species treated in this work, whenever possible, I compared the range of variability of this species in its natural habitat with that which appeared under uniform conditions in the experimental field or greenhouse. In each case, plants grown from the tubers of the originally collected plants were used for comparison with the herbarium specimens (see under "Species Examined"). Although this technique served me very well in most instances, I sometimes found problems with the growth of plants under experimental conditions. Plants grown from *Ochoa 13537*, for example, developed the decurrent lateral leaflets characteristic of *S. raphanifolium* when planted in the open field, but not when grown in the greenhouse.



HERBARIO OCHOA

Solanum raphanifolium Card. et Hawk.

PERU: dpto. Cusco, prov. Canchis, Sicuani, Cerro Calvario cerca de Jururo, 3700-3800 m alt., al este de la Plaza de Armas de Sicuani. Abril 4, 1978, *C. Ochoa 12040* (topotipo de *S. pumilum*)

Det. C. Ochoa

Figure 147. *Solanum raphanifolium* (*Ochoa 12040*, collected in the type locality of "*S. pumilum*").

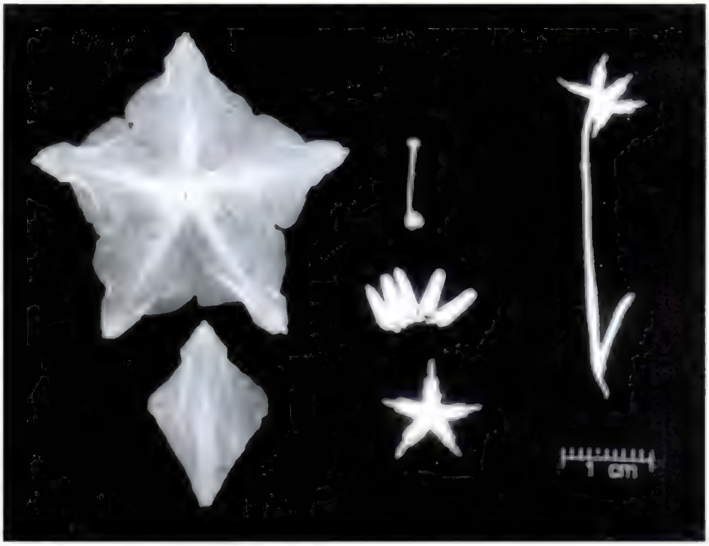


Figure 148. Floral dissection of *Solanum raphanifolium* (*Ochoa 15121*, topotype).

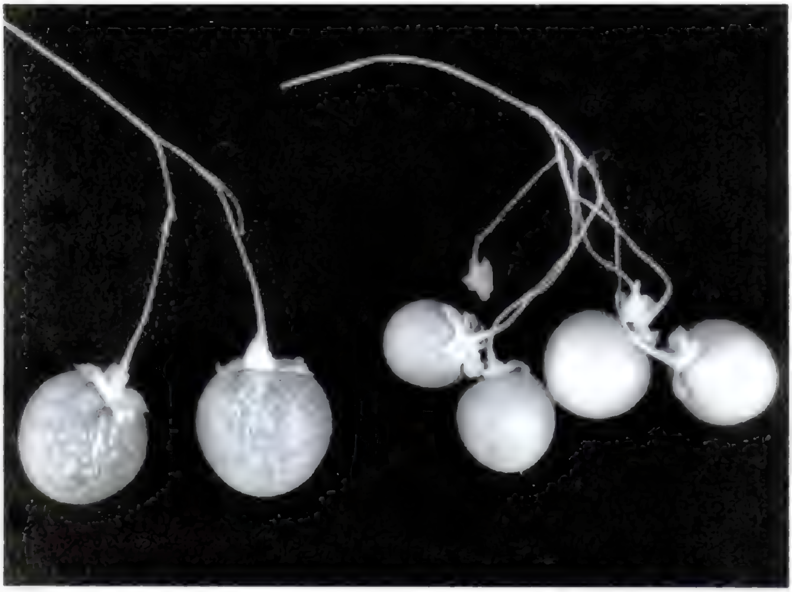


Figure 149. Ornamentation and fruit shape of *Solanum raphanifolium* (Left, *Ochoa 12040*; Right, *Ochoa 13705*).

Affinities

Although not clearly evident from all of its ecotypic forms, this species is related to *S. megistacrolobum*. In the long- and medium-stemmed individuals of this species, this relationship is demonstrated by the presence of simple basal leaves or compound lower leaves that are only poorly divided, and by middle or upper leaves that have an enormously enlarged terminal leaflet. Some rosette forms of *S. raphanifolium* are extremely close to *S. megistacrolobum* in both their leaves and habit.

Habitat and Distribution

Although known from a variety of soil and climatic conditions, this species grows preferentially in disturbed soils. For this reason, it is often found near or within cultivated fields of maize, potatoes and other crops. However, it is also sometimes encountered in localities far away from areas of human occupation. In the more remote, outlying sectors of its range, this species grows in virgin soils under a variety of climatic conditions.

In the vicinity of its type locality at Sakksayhuamán near Cusco (Figs. 151 and 152), this species is associated with *Alternanthera*, *Bacharis*, *Bidens*, *Brassica*, *Calceolaria*, *Castilleja*, *Capsella*, *Cassia*, *Oxalis*, *Oenothera*, *Plantago* and various grasses. It also grows in close association with the tuberous species *S. bukasovii* at this ancient Inca fortress.

This species is widely distributed in southern Peru, encompassing the departments of Apurímac, Cusco and Puno (see Map 14). However, its major center of abundance lies in the inter-Andean valleys formed by the Vilcanota and Urubamba rivers.

Altitudinally, this species generally occurs at elevations between 3000 and 3500 m. However, some plants occur at approximately 4200 m near Pomacanchi in the province of Acomayo, Cusco, whereas at Machu Pikchu, Cusco, populations of this species descend to approximately 2000 m.

In the areas of its range where this species occurs at above 3400 m, it grows commonly in forests of *Polylepis* and *Buddleja* or in thickets, the latter formed by various herbs and shrubs of the genera *Barnadesia*, *Chuquiraga*, *Lupinus*, *Berberis* and *Mintostachys*, with an understory of *Stipa*, *Poa*, and *Festuca* grasses, and herbaceous plants of the genera *Urtica*, *Senecio*, *Malvastrum* and *Oenothera*. Collections of *S. bukasovii* have also been obtained from these same thicketed areas, as well as, but more rarely, *S. megistacrolobum*.

Solanum raphanifolium grows at altitudes between 2700 and 3400 m in the inter-Andean valleys. Here it is associated with *Solanum sparsipilum*, *Begonia* (n.v. Achangaray), *Mutisia*, *Sonchus*, *Spartium*, *Calceolaria*, *Crotalaria*, *Datura*, *Desmodium*, *Eupatorium*, *Rubus*, cacti such as *Opuntia* and *Trichocereus*, and trees such as *Schinus molle* and *Escallonia resinosa*.

Specimens Examined

Department Apurímac

Province Abancay: Highlands vicinity of Hacienda Tambobamba, near Huanipaca, 3750 m alt., growing near *S. bukasovii*, February 1980, C. *Ochoa 13604A*, 2n=24 (CIP, F, NY, MOL, OCH, US).

Province Antabamba: A few meters from the Mollebamba River, on the road to Calcausto, 3300 m alt., corolla subpentagonal, purple, 22 February 1980, C. *Ochoa 13664*, 2n=24 (CIP, NY, OCH, US). Huasacalle, 3350 m alt., near Pichipay, annexed to Totora, in thickets of *Mutisia*, *Spartium* and *Sonchus*, 7 March 1980, *Ochoa 13735*, 2n=24 (CIP, F, MOL, NY, OCH, US). Adriano, 3250 m alt., near the Totora-Oropeza River, about 1 hour, heading down from Huachajray by horse toward the mentioned river, in stony soil, among small trees of *Schinus molle*, shrubs of *Cassia*, herbs such as *Begonia* and various grasses, March 1980, C. *Ochoa 13741* (OCH).

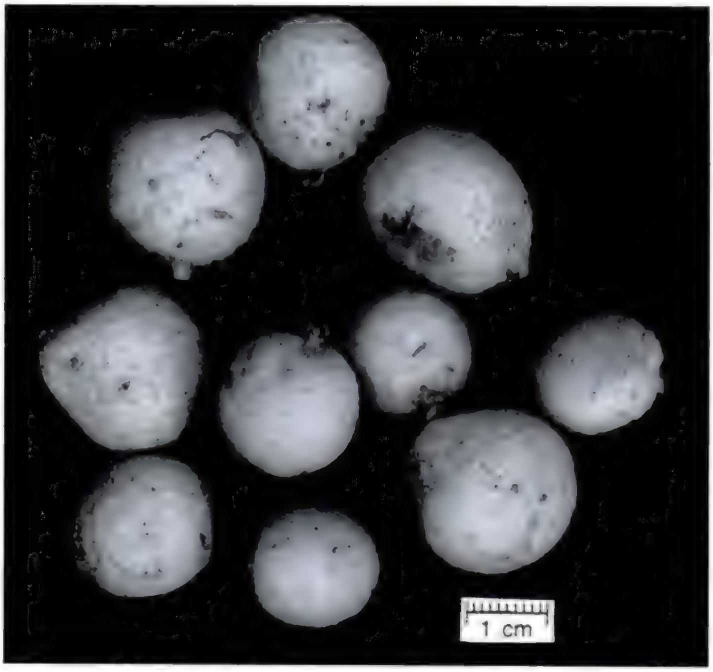


Figure 150. Tubers of *Solanum raphanifolium* (*Ochoa 13564*).

Province Grau: Chuquibambilla, 3000 m alt., 24 February 1960, C. *Ochoa 2223* (OCH). Environs of Pamparacay, 3300 m alt., 25 February 1960, C. *Ochoa 2228* (OCH). Puishr'o, 3000 m alt., 5 km from Airihuanca, on the Vilcabamba-Airihuanca road, 26 February 1960, C. *Ochoa 2240* (OCH).

Department Cusco

Province Acomayo: Acomayo, 3050 m alt., on farms, March 1948, C. *Vargas* C. *7084* (LL). Vicinity of the cemetery of Pomacanchi, 3735 m alt., 6 April 1975,

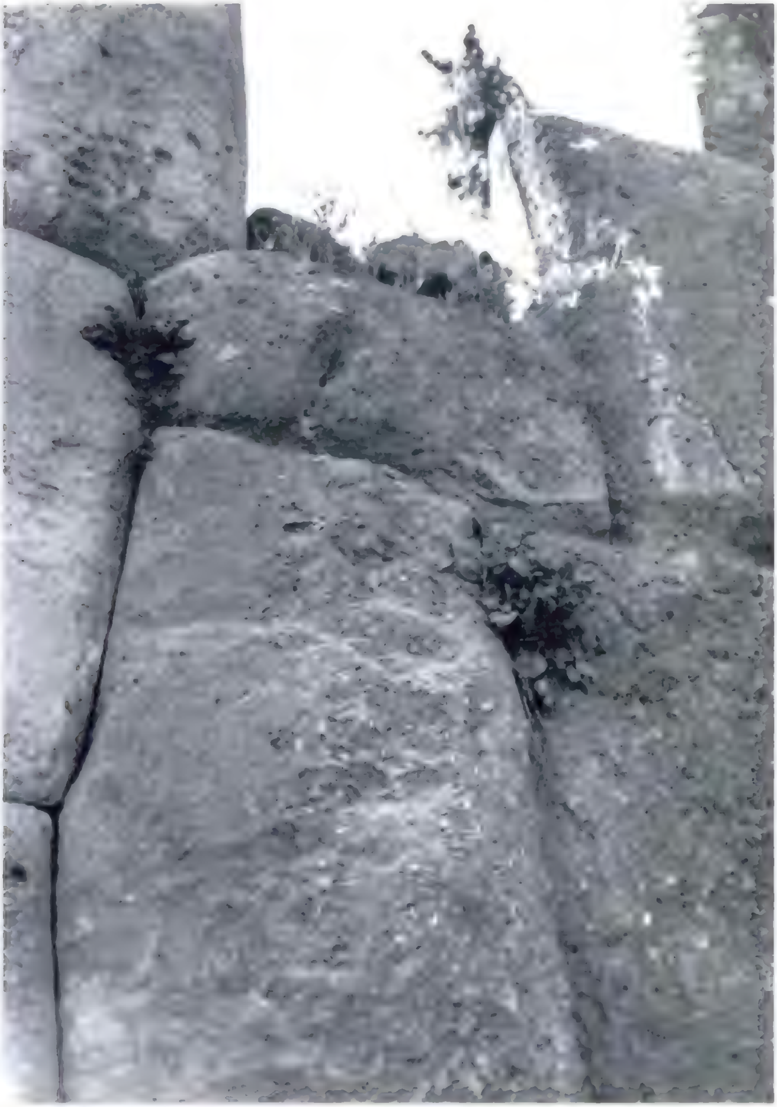


Figure 151. Plants of *Solanum raphanifolium* growing between the rock crevices of Fortress Sakksayhuaman (3500 m alt.), Cusco.

C. Ochoa 7610 (CIP, F, MOL, NY, OCH, US), *7612*, 2n=24 (CIP, OCH, US), *7613*, 2n=24 (CIP, OCH, US), and *7614* (OCH). Cerro Ccayahua-Pucara, northeast of Pomacanchi, ca. 3600 m alt., 6 April 1975, *C. Ochoa 7617 and 7618* (OCH). Cerro Ccayahua-Pucara, northeast of Pomacanchi, 3550 m alt., 6 May 1975, *C. Ochoa 7619*, 2n=24 (CIP, OCH). Yanampampa, on road to Pomacanchi, 3610 m alt., at the base of enclosures, with *Poa*, flowers up to 4 cm in diam., 12 March 1980, *C. Ochoa 13728*, 2n=24 (CIP, F, MOL, NY, OCH, US). Cerro Jocohuachana, 4100 m alt., n.v. *Alkko-papa*, amid *Stipa*, *Mutisia* and *Chuquiraga*, March-April 1981, *R. Ortega 020* and *021* (OCH, from plants grown at the Experiment Station of K'ayra, near Cusco, 1982). Mancura, 3800 m alt., in *puna*, amid *Stipa ichu*, n.v. *Alkko-papa* (= Dog Potato), March-April 1981, *R. Ortega 023* (OCH, from a plant grown at the Experiment Station of K'ayra, near Cusco, 1982). Canchanhura, 4000 m alt., n.v. *Alkko-papa*, amid *Stipa ichu*, March-April 1981, *R. Ortega 025* (OCH, from a plant grown at the Experiment Station of K'ayra, near Cusco, 1982). Cerro Pucara, 4200 m alt., Distr. Pomacanchi, amid *Stipa*, *Chuquiraga* and *Puya*, near cultivated fields, especially of wheat and potato, March-April 1981, *R. Ortega 026* and *027* (OCH, from plants grown at the Experiment Station of K'ayra, near Cusco, 1982). Cerro Jocohuachana, 4100 m alt., Distr. Pomacanchi, amid *Stipa ichu* and *Puya*, February 1982, *R. Ortega 036* (OCH). Cerro Jocohuachana, 4100 m alt., amid ichu (= *Stipa*), chinchercoma (= *Mutisia*) and achupalla (= *Puya*), near cultivated fields of potato, oca, añu and

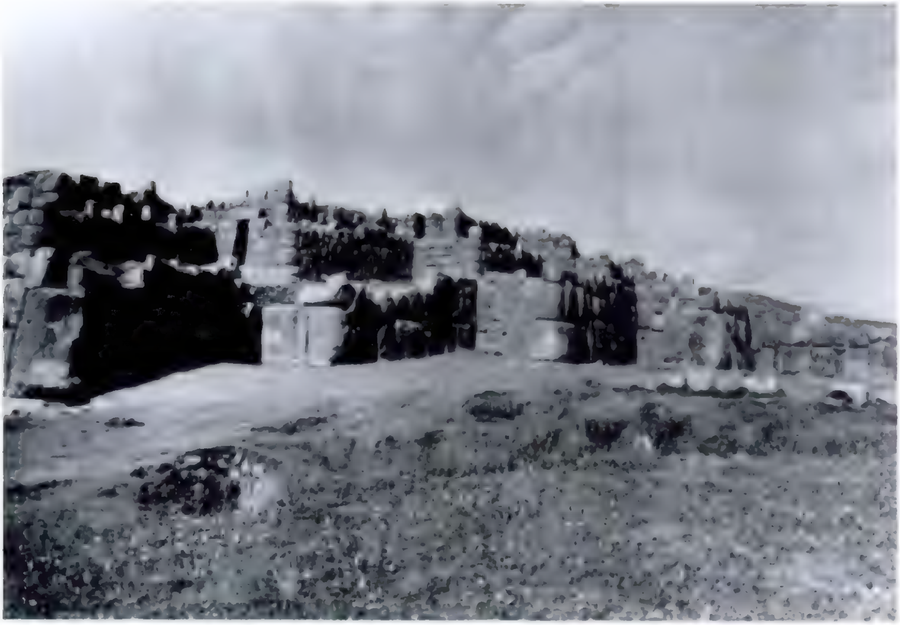


Figure 152. Fortress Sakksayhuaman (3500 m alt.), Cusco, type locality of *Solanum raphanifolium*.

tarwi, February 1982, *R. Ortega 039* (OCH). Conchacalla, 3700 m alt., Distr. Pomacanchi, on the Conchacalla-Kero road, among *Pennisetum* sp., February 1982, *R. Ortega 046*, *047* and *050* (OCH). Conchacalla-Jatunpujio, 3700 m alt., Distr. Pomacanchi, amid *Pennisetum clandestinum* and *Urtica*, February 1982, *R. Ortega 048* (OCH). Hatun Kero and Conchacalla, 3700 m alt., Distr. Pomacanchi, amid *Chuquiraga*, *Mintostachys* and *Lupinus* sp., near cultivated fields, February 1982, *R. Ortega 057 and 058* (OCH). Luruchayoc, at km 25.5 on the Chuquicahuana-Acomayo road, 3650 m alt., amid *Cassia*, *Barnadesia*, *Senecio*, *Opuntia exaltata*, *Salvia* (= Nujchu), *Calceolaria* and *Puya*, 18 March 1984, C. *Ochoa 15690*, 2n=24 (OCH). Outlet of the Pomacanchi lagoon, 3800 m alt., 15-18 March 1984, C. *Ochoa 15699A*, 2n=24 (OCH). Cebadapata, 3500 m alt., potato and maize farms, along the edges of farms, left bank of the small stream that flows out of the Pomacanchi lagoon, 15-18 March 1984, C. *Ochoa 15700A* (OCH).

Province Anta: Pampa de Anta, 3400 m alt., along the edges of farms, corolla purple, 18 January 1945, *C. Vargas C. 4856 p.p.* (CUZ, LL) and (OCH, plants 1, 2 and 3, leaf of *S. raphanifolium*, and 4, leaf of *S. sparsipilum*). Chacán, 3500 m alt., on the Cusco-Urubamba road, flowers blue, 11 February 1960, C. *Ochoa 2173* (OCH). Just east of Izcuchaca on the Izcuchaca-Cusco road, 3300 m alt., growing along the weedy road, 9 March 1963, *D. and V. Ugent s.n.* (WIS). Chacán, 7 km north of Izcuchaca on the Izcuchaca-Urubamba road, 3500 m alt., weed in maize fields and along roads, 9 March 1963, *D. and V. Ugent and C. Vargas C. 4180* (US); *4181* (F); *4186*, sheet 2 (OCH); *4187*, sheets 1-2 (WIS). Just east of Izcuchaca, on Izcuchaca-Urubamba road, 3440 m alt., n.v. *Arakk papa*, growing along the weedy roadside, 9 March 1963, *D. and V. Ugent 4222*, sheets 1-2 (WIS); *4223*, sheet 3 (US); *4225*, sheet 1 (WIS); *4227* (F). 2 km from Anta on the road to Urubamba, 2550 m alt., by construction at roadside, plants to 1 m tall, blue-violet flowers, 10 April 1971, *J.P. Hjerting, P.J. Cribb and Z. Huamán 5095* (CIP). Between Anta and Urubamba, Chequerecc, 3500 m alt., in wall by maize field, 10 April 1971, *J.P. Hjerting, P.J. Cribb and Z. Huamán 5097* (CIP). Callpana, 3400 m alt., above Cachimayo, April 1971, C. *Ochoa 3051* (OCH). Vicinity of Cachimayo, 3400 m alt., April 1971, C. *Ochoa 3053* (OCH). Ckehuar, 3460 m alt., 6 May 1975, C. *Ochoa 8333*, 2n=24 (CIP, F, MOL, NY, OCH, US). Ccaccapampa, 3450 m alt., near Huarocondo, on the Izcuchaca to Huarocondo road, about 2 km before Huarocondo, at the base of old adobe walls, flowers deep purple, berries round, sparsely speckled with small white dots, 11 February 1980, C. *Ochoa 13610* (CIP, OCH, US) and *13610A*, 2n=24 (CIP, OCH). Sallán, 3450 m alt., about 1 km before Huarocondo, entering by the road to Izcuchaca, among large rocks, 11 February 1980, C. *Ochoa 13611*, 2n=24 (CIP, F, MOL, NY, OCH, US) and *13611A* (CIP, OCH). Wilqui Pass, between Zurite and

Limatambo, 3650 m alt., amid *Salvia, Monnina, Bidens, Chuquiraga, Desmodium, Alonsoa* and *Astragalus*, 16 March 1981, *C. Ochoa 14323* (CIP, NY, OCH, US). At km 52 on the Cusco-Abancay road, 3640 m alt., *L.E. López 1680* (CIP).

Province Calca: Huancalle, 3400 m alt., open hillsides with small herbs, 4 January 1946, *C. Vargas C. 5519* (CUZ, OCH). Ruins of Intihuatana, above Pisac, 3300-3400 m alt., 24 April 1953, *Peterson and J.P. Hjerting 1529*, 2n=24 (= *PI-210049*, from plants grown at Sturgeon Bay, Wis., USA); *1529.3*, 2n=24 (= *PI-210049.3*) (LL); *1531* (from plants grown at Sturgeon Bay, Wis., USA). Vicinity of the ruins of Intihuatana, 3450 m alt., berries spherical to slightly ovoid, pale green with whitish dots, 24 April 1953, *C. Ochoa 2061* (OCH). Coya, a weed in maize fields, 27 February 1958, *D.S. Correll, E.E. Smith and C. Vargas C. P228* (LL). Near Calca, on stone walls and along roadsides, 3000 m alt., flowers purple, 27 February 1958, *D.S. Correll, E.E. Smith and C. Vargas C. P230* (F, NY); *P230*, sheet 1 (LL). Terraces of Pisac, 3300 m alt., 16 February 1960, *C. Ochoa 2188* (OCH). Pisac, 2800 m alt., near bridge, 16 February 1960, *C. Ochoa 2191* (OCH). Machacancha, 2860 m alt., near Calca, 19 February 1960, *C. Ochoa 2201* (CIP, OCH, US). Arín, 3000 m alt., in stones, 6 March 1960, *C. Vargas C. 13138* (WIS). Km 56 on the Cusco-Calca road, ca. 6 km west of Calca (6 km east of Yucay), 2900-3000 m alt., 29 December 1962, *H. and C. Iltis and D. and V. Ugent 933 p.p.* (WIS). Bottom of Urubamba River valley at km 56 on Cusco-Urubamba road, ca. 6 km west of Calca, 2900-3000 m alt., near base of rockslide among shrubs and rocks, 29 December 1962, *H. and C. Iltis and D. and V. Ugent 949* (WIS). 9 km (by road southwest of Pisac) on road to, and exactly at km 23 from, Cusco, 3800 m alt., rocky quebrada and steep upper slopes of side valley of Urubamba River, 30 December 1962, *H.H. Iltis and D. and V. Ugent 967* (US, WIS). Km 18 on the Cusco-Pisac road (13 km southwest of Pisac), 3800 m alt., roadside, on top of a rock wall bordering a maize field, 17 February 1963, *D. and V. Ugent 3739* (F), *3741-44* (WIS) and *3745-46* (US). Near San Salvador, km 19 between Huambutio and Pisac, 3500 m alt., roadside, among twig fence, 18 March 1963, *D. and V. Ugent 4520*, sheets 1-2 (WIS). Km 23 on the Huambutio-Pisac road (4 km southeast of Pisac), along adobe-twig fence bordering a maize field, 18 March 1963, *D. and V. Ugent 4521 and 4522* (WIS). Ruins of Pisac, 3300 m alt., on terrace under bushes below ruins, 11 April 1971, *J.P. Hjerting, P.J. Cribb and Z. Huamán 5111* (CIP). Heading down from Huancalle to Pisac, 3050 m alt., on stony foothills, lower foothills of Cerro Nustta, amid *Crotalaria* and *Schinus molle, Datura, Salvia, Bidens* and *Nicotiana glauca*, 8 March 1980, *C. Ochoa 13703* (CIP, OCH). In the complex of ruins of Intihuatana, near Pisac, 3430 m alt., past the tunnel on the eastern side, 16 March 1980, *C. Ochoa 13753*, 2n=24 (CIP, OCH). Lower part of the complex of ruins of Intihuatana, Pisac, 3350 m alt., 16 March 1980, *C. Ochoa 13755*, 2n=24 (CIP, OCH). Near complex of ruins of Intihuatana, above the terraces of Pisac, amid *Calceolaria*, *Senecio*, *Eupathorium* and shrubs of *Barnadesia* and *Mutisia*, 16 March 1980, *C. Ochoa 13756* (CIP, OCH). Near Intihuatana and the royal Inca palace, Pisac, 3400 m alt., berries ovoid, light green spattered with whitish dots, 16 March 1980, *C. Ochoa 13759* (CIP, F, MOL, NY, OCH, US). Quishuana, 3100 m alt., heading up from Muchacancha toward the Gorge of Chaiña, growing between *Eupathorium*, *Sonchus*, etc., 14 March 1981, *C. Ochoa 14302* (OCH). Muchacancha, on the Calca-Amparaes road, 3300 m alt., corolla semipentagonal, deep blue, 14 March 1981, *C. Ochoa 14318*, 2n=24 (CIP, F, MOL, NY, OCH, US). In the ruins of Pisac, facing the sun dial, ca. 3400 m alt., April-May 1981, *C. Ochoa 14414*, 2n=24 (CIP, NY, OCH, US), *14415*, 2n=24 (CIP, F, OCH, US).

Province Canas: Puente Asunción, spanning the Apurímac River, 3800 m alt., hillsides to about 30 m above the level of the river, abundant, amid *Malvastrum*, *Oenothera*, *Begonia* (n.v. = Achangaray), *Barnadesia*, *Senecio* and various grasses, 15-18 March 1984, *C. Ochoa and O. Blanco 15682* (CIP, F, MOL, NY, OCH, US). Yanahuara, 3800 m alt., 1 km from Tungasuca on the Tungasuca-Yanaoca road, 10 April 1986, *D. Rabinowitz and D. Begazo 385* (OCH).

Province Canchis: Between Araranca and Aguas Calientes, 3780 m alt., 13 April 1915, *O.F. Cook and G.B. Gilbert 185* (US). Temple of Viracocha, near Tinta, 3500 m alt., 13 April 1915, *O.F. Cook and G.B. Gilbert 199* (US). Slopes of Sicuani, 3750 m alt., among herbaceous plants and moss, 24 February 1939, *C. Vargas C. 9839 p.p.* (F). Huantura, Combapata, among stones on farms, corolla purple, 26-27 February 1945, *C. Vargas C. 5002* (LL). Cerro Calvario, 3600-3700 m alt., to the east and above the main plaza of Sicuani, same type locality of "*S. pumilum,*" 22 April 1962, *C. Ochoa 2429* (OCH). Cerro Calvario, 3650-3750 m alt., about 500 m above and to the east of the Plaza de Armas of Sicuani, topotype of "*S. pumilum,*" April 1962, *C. Ochoa 2441* (CIP, MOL, OCH). At Evangelical Mission in Sicuani, 3500 m alt., weeds in maize field, 8 January 1963, *H. and C. Iltis and D. and V. Ugent 1225* (F, OCH, US, WIS). Halfway between Sicuani and La Raya Pass, east-southeast of Maranganí, ca. 8 km (rd.) west-northwest of Ocobamba, field with maize and many potatoes intermixed, 8 January 1963, *H.H. Iltis and D. Ugent 1227* (F, OCH, WIS), *1228* (WIS) and *1229* (US, WIS). Sicuani, 3500 m alt., edge of maize field, northeast of city on the Sicuani-Cusco road, 1 March 1963, *D. and V. Ugent 4004* (US) and *4005* (WIS). About 7 km (air distance) south of Sicuani, 3500 m alt., growing in rocky soil at edge of thicket bordering a native farm house and maize field, 1 March 1963, *D. and V. Ugent 4022* (WIS). Maranganí, 11.2 km south-southeast of Sicuani, growing with *Opuntia* sp. on top of rock-rubble wall bordering cultivated field, 25 March 1963, *D. and V. Ugent 4525* (WIS). Sicuani, Calvario, 3600 m alt., at edge of Calvario at sides of stream, 8 April 1971, *J.P. Hjerting, P.J. Cribb and Z. Huamán 5083* (CIP). Viracocha ruins at Rakchi, near San Pedro on Puno-Cusco road, 3550 m alt., on walls near ruins, 8 April 1971, *J.P. Hjerting, P.J. Cribb and Z. Huamán 5086* (CIP). Sicuani, Cerro Calvario, 3650 m alt., same type locality of "*S. pumilum*," 4-7 April 1978, *C. Ochoa 12040* (CIP, F, NY, OCH, US). La Raya, 1 km below the farm of the Camélidos Americanos, 4000 m alt., growing with *Solanum bukasovii*, 24 January 1980, *C. Ochoa 13537* (CIP, OCH, from plants grown in the greenhouse and field at Huancayo). Above an old wall of the cemetery at Maranganí, 3600 m alt., flowers small, purple, 28 January 1980, *C. Ochoa 13562*, 2n=24 (CIP, OCH, US). Above Cerro Calvario, 3800 m alt., 12 March 1980, *C. Ochoa 13726* (CIP, OCH, US). Sicuani, Cerro Calvario, 3600 m alt., about 600 m above and to the east of the main plaza of Sicuani, 12 March 1981, *C. Ochoa 14298*, 2n=24 (CIP, F, MOL, NY, OCH, US). Sicuani, Jururo, above Cerro Calvario, 3700 m alt., berries round or very slightly ovoid, pure light green or light green with a few small white specks, 12 March 1981, *C. Ochoa and A. Salas 14299*, 2n=24 (CIP, F, MOL, NY, OCH, US). Vicinity of the Aguas Calientes railroad station, between La Raya and Maranganí, 4050 m alt., 11 March 1984, *C. Ochoa 15628*, 2n=24 (CIP, F, MOL, NY, OCH, US), and *15629*, 2n=24 (CIP, F, OCH). Cemetery at Maranganí, 3750 m alt., associated with grasses and composites, 11 March 1984, *C. Ochoa 15630*, 2n=24 (CIP, OCH), and *15631*, 2n=24 (CIP, NY, OCH, US). Cerro Calvario, 3700 m alt., above and to the east of the main plaza of Sicuani, in poor clay-gravel soil, protected by *Berberis*, amid *Calceolaria* and *Bidens*, 11 March 1984, *C. Ochoa and A. Salas 15632*, 2n=24 (CIP, NY, OCH, US), and *15633*, 2n=24 (CIP, NY, OCH, US).

Province Cusco: Hills of Sakksayhuamán, 3500 m alt., March 1929, *F.L. Herrera 2343* (F). Sakksayhuamán, 3600 m alt., 19 March 1942, *C. Vargas C. 2605* (LL). Fortress of Sakksayhuamán, near Cusco, March 1943, *M. Cárdenas and H. Gandarillas 3500* (K) and *3501* (CPC). Cerro Cachana, south of Cusco, 3520 m alt., stony hillside, under shade of *Cassia* shrubs, 25 January 1948, *C. Vargas C. 7040* (LL). Ruins of Sakksayhuamán, 3450 m alt., 24 April 1953, *Peterson and J.P. Hjerting 1521 = PI-210048* (CIP, from plant grown in the greenhouse at CIP-Huancayo, 29 January 1969, from seed sent by IR-1, Sturgeon Bay, Wis., USA) and *PI-210048.1* (LL, from plant grown in fields at Sturgeon Bay, Wis., USA, 25 August 1955). Fortress of Sakksayhuamán, above Cusco, rocky slopes and fields, plants up to 3.5 ft. tall, flowers deep purple, 3 cm across, rotate-stellate, tubers round, white, 26 February 1958, *D.S. Correll and E.E. Smith P218*, topotypes of *S. raphanifolium*, sheet 1 (LL, NY, US) and sheet 2 (LL). On gravelly mound near Fort Pucara, 7 km from Cusco on road to Pisac, 3750 m alt., plants dwarf, flowers dark purple, rotate-stellate, tubers small, less than 1 cm in diam., 26 February 1958, *D.S. Correll and E.E. Smith P219* (LL, US). Fort Pucara, 7 km from Cusco on road to Pisac, 3750 m alt., plants rosette, flowers purple, rotate-stellate, tubers round, up to 1 cm in diam., 26 February 1958, *D.S. Correll and E.E. Smith P220* (LL, US). Fort Pucara, 7 km from Cusco, 3750 m alt., tubers more than 2 cm in diam., 26 February 1958, *D.S. Correll and E.E. Smith P221* (LL). Ccorau, 15 km from Cusco on road to Pisac, rocky open slope, 3500 m alt., flowers deep purple, rotate-stellate, 27 February 1958, *D.S. Correll and C. Vargas C. P224* (F, LL). Rocky field between San Gerónimo and Sailla, 3250 m alt., flowers deep purple, stems purplish, tubers round, purplish, 1 March 1958, *D.S. Correll, E.E. Smith and C. Vargas P233* (LL, US). Along rocky bank of mountain stream above Huancaro on way to Paruro, 3300 m alt., flowers dark purple, rotate-stellate, 1 March 1958, *D.S. Correll, E.E. Smith and C. Vargas C. P240* (UC, NY) and *P240*, sheets 1-2 (LL). Recoleta, Cusco, on edge of fields, flowers purple with white stripes radiating, tubers round, up to 4.5 cm in diam., flesh fused with purple, fruits ovoid, 2 cm long, dark green marked with darker green stripes, 2 March 1958, *D.S. Correll, E.E. Smith and C. Vargas C. P241 p.p.* (LL). Ckencko, 3400 m alt., 11 February 1960, *C. Ochoa 2175* (CIP, OCH). Fortress of Sakksayhuamán, 3400 m alt., 11 February 1960, *C. Ochoa 2176* (topotype, OCH). Granja K'ayra, 3400 m alt., 11 February 1960, *C. Ochoa 2178* (CIP, OCH). Ruins of Inca fortress of Sakksayhuamán, 3500 m alt. (13°31' S, 71°58' W), above Cusco with *Solanum raphanifolium*, *S. canasense*, *Cassia*, *Bidens*, *Mutisia*, *Baccharis*, *Oenothera*, *Calceolaria*, *Castilleja*, *Veronica*, *Euphorbia*, *Rumex*, *Capsella*, *Brassica*, *Plantago*, *Cerastium*, *Stellaria*, *Hypoxis*, *Lupinus*, *Verbena* and non tuberous *Solanum* sp., 1 January 1963, *H.H. Iltis and D. Ugent 1168*, two sheets (WIS); *1169*, two sheets (WIS); *1170* (F, US, WIS); *1180*; *1182*; *1192*; *1193*; *1195*, three sheets; *1196* (WIS). 5.5 km south-southeast of Cusco, on the Cusco-Paruro road, growing in weedy maize field, 12 February 1963, *D. and V. Ugent and C. Vargas C. 3512* (US) and *3515* (WIS). On gentle slope and on footpath above small stream, 3455 m alt., with *Mutisia*, *Cassia*, *Baccharis*, *Calceolaria*, *Begonia*, *Festuca*, *Stipa ichu*, *Solanum raphanifolium*, *S. hawkesii* and *S. lechnoviczii*, 12 February 1963, *D. Ugent and C. Vargas C. 3519* (WIS), *3520* (OCH), *3522* (F), *3523* (WIS), *3524* (US) and *3529* (WIS). 11 km south of Cusco on road to Paruro, 3455 m alt., 12 February 1963, *D. Ugent and C. Vargas C. 3530* (OCH). Ruins of Sakksayhuamán, 3500 m alt. (13°31' S, 71°58' W), growing in rocky soil on top ledge of Inca wall, mass collections at different locations made on 12-16 February 1963, *D. and V. Ugent* as follows: loc. 41: *3509*, *3510*; loc. 1: *3536*, *3542*; loc. 2: *3544*; loc. 3: *3548*; loc. 5: *3552*; loc. 6: *3554-56*; loc. 7: *3562*, *3563*; loc. 8: *3565*, *3566A*, *3569* and *3570*; loc. 9A: *3576*, *3578*, *3583*, *3585*, *3588-89* and *3590*; loc. 10: *3593*; loc. 12: *3598*; loc. 16: *3614-15*; loc. 17: *3616*; loc. 18: *3623-24*, *3629*; loc. 19: *3630*; loc. 20: *3634*;

loc. 21: *3638*; loc. 22: *3641*; loc. 23: *3647*; loc. 24: *3649*; loc. 25: *3650*; loc. 26: *3652*; loc. 29: *3667-68*; loc. 30: *3673-75*; loc. 32: *3679*, *3680*; loc. 34: *3686*; loc. 35: *3690-94*; loc. 36A: *3699*, *3700*; loc. 36B: *3702*, *3703*; loc. 37: *3709-10*; loc. 38: *3713*; loc. 39: *3714*; loc. 40: *3720*. All these specimens are housed in the University of Wisconsin Herbarium, Madison, Wis., USA (WIS); while *D. and V. Ugent* loc. 11: *3596*; loc. 29: *3669*, collected in the same locality, are housed in OCH. 'Kenkko amphitheatre of Inca ruins above (northeast) Cusco, 3500 m alt., growing in the crevice between two large stones at the damp base of a wall, 16 February 1963, *D. and V. Ugent 3721* (US), *3724* (WIS), *3725* (OCH) and *3726* (F). About 6.4 km from Cusco on road to Abancay, 3500 m alt., eroded slope between cultivated potato field and roadside, with *Vaccinium*, *Bidens*, *Oxalis*, *Lepidium* and *Erodium*, *Solanum raphanifolium* mainly on bare open soil, 21 February 1963, *D. and V. Ugent 3810* (WIS), *3811* (F), *3812* (US), *3816* (WIS) and *3817-18* (WIS). About 4.3 km from Cusco on road to Abancay, 3500 m alt., eroded slope between cultivated potato field and roadside, with *Vaccinium*, *Bidens*, *Oxalis*, *Lepidium* and *Erodium*, *Solanum raphanifolium* mainly in shade of roadside thicket, 21 February 1963, *D. and V. Ugent 3827* (F), *3830* (OCH), *3831* (US), *3832*, sheet 5 (OCH), *3833*, sheet 1 (WIS) and *3833*, sheet 2 (WIS). 4.5 km from Cusco on road to Pisac, at turnoff to Grupo Arqueológico de Lago, 3500 m alt., roadside population of *Solanum raphanifolium* highly variable in height, habit, and leaf shape, with *Bidens*, *Cirsium*, *Mutisia*, *Calceolaria*, *Cassia* and nontuberous *Solanum* sp., 22 February 1963, *D. and V. Ugent 3834-35* (F), *3837* (OCH), *3838* (F), *3839* (US), *3840* (WIS), *3841* (US), *3844* (WIS) and *3847* (WIS). Simacucha-Cachimayo, 0.5 km north on the turnoff road to Chincheros from the Cuzco-Izcuchaca road (near Poroy), 3500 m alt., growing on top of stone wall bordering maize field, 23 February 1963, *D. and V. Ugent 3911* (US) and *3916* (WIS). 4.8 km up the side road to Chincheros from turnoff on Cusco-Anta road, 3500 m alt., weedy maize field with *Solanum raphanifolium*, *Vicia faba*, *Brassica*, *Oxalis* and *Veronica*, 23 February 1963, *D. and V. Ugent 3917* (US), *3918* (OCH), *3921* (F) and *3923* (WIS). At 1.6 km north of the turnoff Chincheros from the Cusco-Izcuchaca road (6.4 km north of Poroy), weedy roadside thicket, in deep shade, 23 February 1963, *D. and V. Ugent 3942* (WIS). Pucara, Inca ruin 7 km north-northeast of Cusco on the Cusco-Pisac road, 3500 m alt., growing in rocky soil on top of a wall, 27 February 1963, *D. and V. Ugent 3953-5* (OCH) and *3963* (F). Pucara, Inca ruin 7 km north-northeast of Cusco on the Cusco-Pisac road, 3500 m alt., growing along the open roadside, 27 February 1963, *D. and V. Ugent 3964* (US) and *3968* (WIS). 7 km northwest of Cusco on the Cusco-Pisac road, 3500 m alt., small Inca ruin on rocky hillside facing Fort Pucara, with *Mutisia*, *Calceolaria*, *Baccharis*, *Pilea* and *Opuntia* sp., 27 February 1963, *D. and V. Ugent 3974* (WIS). 4 km from Cusco on road to Pisac, 3500 m alt., rocky bluff and gorge, with *Calceolaria*, *Galium*, *Cassia*, *Baccharis*, *Castilleja*, *Epilobium*, *Sisyrinchium*, *Solanum raphanifolium* and *S. canasense*, 4 March 1963, *D. Ugent 4080*, *4081* (US) and *4083* (F). Fort Pucara, Inca ruin, 7 km north-northeast of Cusco on the Cusco-Pisac road, 3500 m alt., growing on a mound of rocky soil in front of the ruins, 6 March 1963, *D. and V. Ugent 4100-3* (WIS). Poroy, about 6 km east-northeast of Cusco (air distance), rocky, weedy roadside, 9 March 1963, *D. and V. Ugent 4229* (WIS). "Grupo Arqueológico de Lago," 4.5 km from Cusco (on Cusco-Pisac road) and 1 km east on turnoff to ruins, 3600 m alt., growing along the roadside, 16 March 1963, *D. and V. Ugent 4447 and 4448* (WIS). Stone quarry near Grupo Arqueológico, 3600 m alt., 4.5 km north of Cusco (on the Cusco-Pisac road), about midway between the ruins of Sakksayhuamán and Tambomachay, in cultivated field, hybrid swarm of *Solanum megistacrolobum* and *S. canasense*, mass collections include those of the parental species putative F_1 and F_2 segregates, 6-16 March 1963, *D. and V. Ugent 4122*, sheets 1-2; *4123*, *4127*, sheet 2; *4251*, *4256*, *4257*, *4259*, *4260*, *4261-2*, *4265*, *4268*, *4269*, *4270*, *4272*, *4273*, *4275* and *4438*. All these specimens are housed in WIS, whereas *D. and V. Ugent 4276*, collected in the same locality, is housed only in OCH. "Grupo Arqueológico de Lago," 3700 m alt., near 'Kenkko, February 1974, *C. Ochoa 5027 = PI-473502* (CIP, OCH, from plants grown at Sturgeon Bay, Wis., USA). Ruins of Sakksayhuamán, 3550 m alt., 13 April 1971, *J.P. Hjerting, P.J. Cribb and Z. Huamán 5141* (CIP, OCH). Llauli-Pucyo-Kishuarpata, near Granja K'ayra, 3400 m alt., March 1974, *C. Ochoa 5206* (OCH). Complex of Arqueológico del Lago, 3700 m alt., near 'Kenkko, February 1974, *C. Ochoa 5027 = PI-473502* (CIP, OCH). Ccorao, 3450 m alt., tubers small, white, 1-4 March 1975, *C. Ochoa 7573*, 2n=24 (CIP, OCH, US). Ruin complex of Piquillacta, on the slopes below the ruins, 3230 m alt., among stones and near the old walls of the ruins, in the shade of *Shinus molle* and with *Plantago*, *Alternanthera*, *Poa* and *Lupinus*, 30 January 1980, *C. Ochoa 13569*, 2n=24 (CIP, OCH). Grupo Arqueológico del Lago, at km 6 on the Cusco-Pisac road, detour, 3640 m alt., abundant, 31 January 1980, *C. Ochoa 13572*, 2n=24 (CIP, OCH), *13574*, 2n=24 (CIP, NY, OCH, US), and *13574A*, 2n=24 (CIP, NY, OCH, US). Puca Pucara, 3750 m alt., 31 January 1980, *C. Ochoa 13575* (CIP, F, MOL, NY, OCH, US). 'Kenkko, 3620 m alt., near Cusco, 31 January 1980, *C. Ochoa 13577* (OCH), *13578*, 2n=24 (CIP, MOL, NY, OCH, US), and *13579*, 2n=24 (CIP, OCH). Huilcarpay, 3500 m alt., 3 km west of San Sebastián, near Cusco, in the stony foothills and in the shade of a large enclosure of *Trichocereus*, abundant, 8 March 1980, *C. Ochoa 13709* (OCH). Granja K'ayra, lower part, 3350 m alt., 29 March 1981, *C. Ochoa 14378* (OCH). Granja K'ayra, lower part, 3350 m alt., associated with *Solanum sparsipilum*, near maize field, 29 March 1981, *C. Ochoa 14380*, 2n=24 (CIP, OCH, US). Sakksayhuamán, between crevices of the megalithic stones of the fortress, 3400 m alt., 1 May 1982, C. *Ochoa 14748*, 2n=24 (CIP, NY, OCH, from plants grown at CIP-Huancayo, US). Sakksayhuamán, 3400 m alt., in open field, berries round and without white specks, 20-30 March 1983, *C. Ochoa 15120*, 2n=24 (CIP, OCH, US), and *15121* (CIP, NY, OCH, US). Sakksayhuamán, between crevices of the megalithic stones of the fortress, fruits round and without white specks, 20-30 March 1983, C. *Ochoa 15122* (OCH). Fortress of Sakksayhuamán, 20-30 March 1983, C. *Ochoa 15123* (OCH). Fortress of Sakksayhuamán, plants typical of the species, fruits round and without white specks, 20-30 March 1983, C. *Ochoa 15124*, 2n=24 (OCH). Fortress of Sakksayhuamán, between crevices of the megalithic stones of the fortress, 30 March 1983, C. *Ochoa 15125*, 2n=24 (CIP, F, NY, OCH, US). Misipata-K'ayra, without date, C. *Ochoa s.n.* (OCH, grown in greenhouse at CIP-Huancayo).

Province Paruro: Tihuicti-Chifia road, 3400 m alt., amid scrub and trees (Chachacomo, etc.), 20 March 1972, C. *Ochoa 3279* (OCH). Paruro, between Chacapata and Huanoquite, ca. 3300 m alt., 20 March 1972, C. *Ochoa 3281* (OCH). Anco-Cunca, 2975 m alt., near Cusibamba, between Paruro and Colcha, 1 January 1980, C. *Ochoa 13585A*, 2n=24 (CIP, OCH).

Province Paucartambo: Sunchubamba, 2900 m alt., 22 February 1960, C. *Ochoa 2209* (CIP, F, OCH, US) and *2210* (OCH). Challabamba, 2900 m alt., 22 February 1960, C. *Ochoa 2211* (OCH). Above Huancarani, on the Cusco-Paucartambo road, 3700 m alt., 9 April 1962, C. *Ochoa 2406* (OCH) and *2408* (CIP, F, OCH, US). Ccomouni, near Churuhuaylla, about 10 km from Huancarani, 3700 m alt., 9 April 1962, *C. Ochoa 2409* (OCH).'Kenkko-mayo quebrada, near Paucartambo, 3160 m alt., rocky walls of the quebrada and along footpath, with *Solanum marinasense*, *S. raphanifolium*, *S. caripense*, *Cassia*, *Tradescantia* and *Phytolaca*, 13 March 1963, *D. Ugent and C. Vargas C. 4425* (F), *4426* (WIS), *4427* (US) and *4429*, sheet 2 (OCH). 7.5 km northwest of Huambutio on the Huambutio-Pisac raod, 3000 m alt., along the Urubamba River, growing on top of stone wall bordering maize field, passing Indian woman called it "Arakk-papa," 18 March 1963, *D. and V. Ugent 4470* (WIS). 9.5 km from Huambutio on road to Pisac, along the Urubamba River, 3000 m alt., (13° S, 71° W), growing under *Schinus molle*, along a rock-*Ephedra*-columnar cactus fence bordering a maize field, with *Oxalis*, *Brassica*, *Cassia* and *Convolvulus.*, 18 March 1963, *V. and D. Ugent 4477* (WIS). Ccuri Orcco, between Huancarani and Ninamarca, 3500 m alt., on the Cusco-Paucartambo road, 22 February 1980, C. *Ochoa 13641* (CIP, OCH, US). Highlands of Pilco, before Acobamba, on the Challabamba-Acobamba road, 2800 m alt., 22 February 1980, *C. Ochoa 13652* (CIP, OCH, US). Near Miski, between Pilco and Challabamba, 2900 m alt., 25 February

1980, *C. Ochoa 13654* (CIP, F, OCH, US). On the Paucartambo-Huaccacca road, plants small, 15-25 cm tall, tubers round to ovoid, white, 2-3 cm long, 26 February 1980, *C. Ochoa 13658* (CIP, OCH, US).

Province Quispicanchis: Piquillacta, 3200 m alt., in rocky field, 1 March 1958, *D.S. Correll, E.E. Smith and C. Vargas C. P234*, flowers pale blue, rotate-stellate, and *P235*, flowers light purple, rotate (LL). Piquillacta, 3200 m alt., on open rocky slope, flowers purplish, 1 March 1958, *D.S. Correll, E.E. Smith* and *C. Vargas C. P237* (US) and *P237 p.p.* (LL). 1.2 km southwest of Oropesa on the Cusco-Urcos road, growing along the borders of a weedy maize field, 28 February 1963, *D. and V. Ugent 3976* (US), *3980*, sheets 1-2 (WIS), *3981*, sheets 1-2 (WIS). "Piquillacta," Inca wall near Oropesa, 3200 m alt., amid ruins and on surrounding hillsides, with *Solanum raphanifolium* and *S. canasense*, 2 March 1963, *D. and V. Ugent 4046* (WIS) and *4049* (US). Near Chuquicahuana, 3350 m alt., April 1978, *C. Ochoa 12509* and *12510* (OCH). Chuquicahuana bridge, at km 80 on the Tinta-Cusco road, 28 January 1980, *C. Ochoa 13563* (CIP, GH, NY, OCH, US), *13564* and *13564A* (OCH, from plants grown in the greenhouse at CIP-Huancayo). Cerro Racchi, southwest of Oropesa, 3120 m alt., 2 February 1980, *C. Ochoa 13587*, 2n=24 (CIP, OCH). Chuquicahuana, 3700 m alt., 16 February 1980, *C. Ochoa 13625*, 2n=24 (CIP, F, GH, NY, OCH, US). Paucarpata, 3800 m alt., near Chuquicahuana, 16 February 1980, *C. Ochoa 13626* (CIP, F, GH, MOL, NY, OCH, US). Canckailli Mocko, between Paucarpata and Tintinco, near Chuquicahuana, 3350 m alt., 12 March 1980, *C. Ochoa 13721* (CIP, F, GH, MOL, OCH, US). Between Paucarpata and Tintinco, 3300 m alt., flowers very dark purple, very odoriferous, 12 March 1980, *C. Ochoa 13723* (CIP, OCH, US).

Province Urubamba: Machu Pikchu, ca. 2000 m alt., edge of moist forest, March 1943, *M. Cárdenas 3506* (CPC, CUZ, type collection of *Solanum hawkesii*). Between Urubamba and Tanahuana, 2800 m alt., maize farms, 11 February 1948, *C. Vargas C. 7070* (LL). Pumahuanca, 2900-3000 m alt., in stony soil, 24 January 1949, *C. Vargas C. 7652* (LL). Heading up from Urubamba toward the Pumahuanca quebrada, 3100 m alt., 15 February 1960, *C. Ochoa 2181* (OCH, US), *2182* (OCH) and *2183* (OCH). Lower end of quebrada Pumahuanca, a deep side valley of Urubamba River, about 2-4 km northwest of Urubamba, 3200-3600 m alt., 31 December 1962, *H.H. and C.M. Iltis and D. and V. Ugent 982 p.p.* (WIS 4 sheets). Lower end of quebrada Pumahuanca, a deep side valley of Urubamba River, about 2-4 km northwest of Urubamba (72°03' W, 13°12' S), 3200 m alt., along road, bottom of slope, hedgerows, pastures, and thickets, bottom of the quebrada, along dirt road from Urubamba, 31 December 1962, *H. and C. Iltis* and *D. and V. Ugent 997 p.p.* (US). Pachar, ca. 2800 m alt., vicinities of railroad station and hedgerows and fields 1 km to the east in broad valley of

Urubamba River, 4 km below Urubamba, 4 January 1963, *H. Iltis and D. Ugent 1139* (WIS), *1139a* (WIS), *1143* (F, OCH, WIS) and *1143 p.p.* plant 1 (US). Chincheros, 13°40' S, 72°1' W, growing on the top edges on the wall of an abandoned, roofless adobe house, 13 February 1963, *D. and V. Ugent 3933* (OCH) and *3935* (US). Chincheros, 13°40' S, 72°1' W, growing along the weedy borders of a cultivated potato field, 23 February 1963, *D. and V. Ugent 3938* (F) and *3940* (WIS). Lower end of Pumahuanca quebrada, a deep side valley of Urubamba River, about 2-4 km northwest of Urubamba, 72°03' W, 13°12' S, 3200 m alt., 24 February 1963, *D. and V. Ugent 3945* (WIS), *3946* (F) and *3951* (US). Salccantay Bajo, 3200 m alt., heading up from Santa Teresa, amid thickets of *Rubus*, 13-15 February 1980, *C. Ochoa 13612* (CIP, F, GH, MOL). Tasquina, 2950 m, heading up from Urubamba by Chicón quebrada, weed in maize field, plant up to 70 cm tall, leaf little divided, flowers purple, n.v. *Jampatu Papa* (= Toad Potato), 5 March 1980, *C. Ochoa 13695* (CIP, MOL, OCH, US). Vicinity of Huanujpampa, heading up Pumahuanca quebrada, 2950 m alt., 8 March 1980, *C. Ochoa 13704*, 2n=24 (CIP, F, GH, MOL, NY, OCH, US). San Antonio, Pumahuanca quebrada, 3060 m alt., in maize fields, plants robust, stems thick, berries ovoid, pure green, 8 March 1980, *C. Ochoa 13705*, 2n=24 (CIP, GH, MOL, OCH, US). P'pita Ccasa, between San Juan and Cuyoc, highlands of Yucay, among grasses and "huarakkos" (= cactus), ca. 3500 m alt., heading up toward Yanaccocha (Yucay quebrada to Pajchaj), plants 30 cm tall, very robust and branched, flowers purple, small, berries round up to 2.5 cm in diam., pure green with the apical third lighter pure green, 17 March 1980, *C. Ochoa 13775*, 2n=24 (CIP, F, GH, MOL, NY, OCH, US). Collismocco, near Llulluchayoc, 3100 m alt., 19-21 March 1981, *C. Ochoa 14346* (OCH).

Department Puno

Province Azangaro: Ckenamare, km 63 on the Aricoma-Crucero road to Puno, 4000 m alt., flowers deep purple, 11 March 1981, *C. Ochoa 14296*, 2n=24 (CIP, GH, OCH, US). San Antón, ca. 4000 m alt., April 1982, *C. Ochoa 14297*, 2n=24 (CIP, F, GH, OCH, US).

Natural Hybrids of *Solanum raphanifolium*

Solanum raphanifolium × *S. bukasovii*

Department Cusco

Province Acomayo: Cemetery at Pomacanchi, 3735 m alt., between adobe walls, flowers dark violet, pentagonal, 6 May 1975, *C. Ochoa 7607*, 2n=24 (CIP, MOL, OCH, from plants grown in the greenhouse at CIP-Huancayo).

Province Cusco: Between Cusco and Huilcarpay about 3 km west of San Sebastián, near Cusco, leaves segmented as in *S. sparsipilum*, 4 pairs of sessile, nondecurrent leaflets and 4 pairs of small interjected leaflets; rachis, leaflets and interjected leaflets without decurrency; terminal leaflet only slightly larger than the laterals, narrowly rhombic-lanceolate with the base cuneate; corolla pentagonal, bright purple, 10 March 1980, *C. Ochoa 13708A* (CIP, OCH). Above Huilcarpay, 3550 m alt., traveling by foot upward toward Cerro Huanacaure, near very rustic dwellings and within maize fields, flowers deep purple, 10 March 1980, *C. Ochoa 13710*, 2n=24 (CIP, GH, OCH, US).

Solanum raphanifolium × *S. sparsipilum*

Department Cusco

Province Cusco: On the lower part of Granja K'ayra, near the entrance, 3350 m alt., margins of maize fields, associated with *S. sparsipilum* and *S. raphanifolium*, 29 March 1981, *C. Ochoa 14379*, 2n=24 (CIP, NY, OCH, US). Apparently introgressed with *S. sparsipilum* but showing dominance from *S. raphanifolium* in the shape of its terminal leaflet and in its strongly pentagonal corolla. Leaves have 3 to 4 pairs of regular to narrowly decurrent leaflets.

Province Quispicanchis: Socco Pujio, 3160-3200 m alt., between Huacapaica and Poquera, facing the eastern side of Huacapaica, plants 40-50 cm tall, flowers purple, n.v. *Arakk Papa*, near cultivated fields, 30 January 1980, *C. Ochoa 13571*, 2n=24 (OCH).

Solanum raphanifolium × *S. sparsipilum*?

Department Cusco

Province Urubamba: Yucay, 2700 m alt., April 1978, *C. Ochoa 12506* (OCH).

Breeding Potential

Despite the reported differences in EBN value between *S. raphanifolium* and *S. lignicaule*, a few viable seeds were obtained in reciprocal crosses involving these two species, but only when *S. raphanifolium* was used as the pistillate parent. However, all crosses between *S. raphanifolium* and *S. dolichocremastrum* from series Megistacroloba or *S. mochiquense* from series Tuberosa (both EBN=1) were unsuccessful, as were the crosses involving this species and *S. wittmackii* (EBN=1). On the other hand, compatibility was found in all reciprocal crosses between *S. raphanifolium* and *S. bukasovii*, *S. bukasovii* f. *multidissectum*, *S. candolleanum*, *S. coelestispetalum*, *S. goniocalyx*, *S. leptophyes*, *S. marinasense*, *S. megistacrolobum*, *S. multiinterruptum*, *S. sparsipilum* and *S. tapojense* all from series Tuberosa. Notice that a relatively high average number of seeds per berry was obtained in crosses of this species with *S. bukasovii* (="*S. canasense*"), one of its putative ancestral forms; whereas, in the case of *S. megistacrolobum*, to which it is closely related (see discussion above), far fewer seeds were obtained. In the reciprocal crosses of this species with *S. megistacrolobum* var. *toralapanum*, a fairly high average number of seeds per berry was obtained, but only when *S. raphanifolium* was used as the staminate parent. All crosses with *S. raphanifolium* involving *S. megistacrolobum* var. *toralapanum* as a pistillate parent failed. Similarly, reciprocal crosses of *S. raphanifolium* with *S. medians* var. *autumnale*-2x and *S. albicans* (EBN=4) were successful only when *S. raphanifolium* was used as the staminate parent. However, some success was found in all unilateral crosses of *S. raphanifolium* with *S. infundibuliforme*, *S. orophilum, S. piurae* and *S. phureja*. Finally, the ease by which genes could be incorporated into the two cultivated species, *S. phureja* and *S. tuberosum* subsp. *andigena*, is suggested by the figures given in Table 37. Especially surprising in this respect is the very high average number of seeds per berry that was obtained in reciprocal crosses involving the diploid cultivated species, *S. goniocalyx*.

Table 37. Fertility of *Solanum raphanifolium* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note following Table 1 for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	Lignicaulia	× *S. lignicaule*	10(9)	5(0)	5(0)
24	1	Megistacroloba	× *S. dolichocremastrum*	19(25)	4(7)	0(0)
24	1	Tuberosa	× *S. mochiquense*	3(20)	1(20)	0(0)
			× *S. wittmackii*	9(6)	1(0)	0(0)
24	2	Conicibaccata	× *S. chomatophilum*	8(16)	3(12)	0(0)
			× *S. limbaniense*	4(36)	1(24)	11(57)
24	2	Cuneoalata	× *S. infundibuliforme*	10	5	82
			× *S. peloquinianum*	3	2	0
24	2	Megistacroloba	× *S. megistacrolobum*	16(39)	3(36)	15(36)
			× *S. megistacrolobum* var. *toralapanum*	10(13)	0(8)	0(106)
24	2	Piurana	× *S. cantense*	8	2	0
			× *S. piurae*	4	1	28
24	2	Tuberosa	× *S. ancophilum*	9(10)	0(0)	0(0)

			× *S. bukasovii*	160(222)	90(151)	105(109)
			× *S. bukasovii* f. *multidissectum*	25(40)	8(21)	22(116)
			× *S. candolleanum*	8(39)	5(28)	107(194)
			× *S. coelestispetalum*	18(42)	8(21)	20(39)
			× *S. goniocalyx*	33(63)	27(41)	104(150)
			× *S. leptophyes*	9(14)	7(3)	16(141)
			× *S. marinasense*	34(18)	20(7)	45(20)
			× *S. medians* var. *autumnale*-2x	15(31)	0(23)	0(28)
			× *S. multiinterruptum*	9(23)	7(9)	37(184)
			× *S. orophilum*	1	1	140
			× *S. phureja*	6	6	43
			× *S. sparsipilum*	61(38)	42(23)	161(108)
			× *S. tapojense*	3(13)	2(9)	150(61)
48	4	Tuberosa	× *S. tuberosum* subsp. *andigena*	3	1	19
72	4	Acaulia	× *S. albicans*	16(23)	6(19)	0(17)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 38. Collections (OCH) used in *S. raphanifolium* fertility studies.

ACAULIA
S. albicans 11842, 12067, 13241, 14789

CONICIBACCATA
S. chomatophilum 11046, 11061, 13203, 14345
S. limbaniense 5201, 14288, 14291, 14293

CUNEOALATA
S. infundibuliforme 11977
S. peloquinianum 13230

LIGNICAULIA
S. lignicaule 11316, 14416

MEGISTACROLOBA
S. dolichocremastrum 12071, 12070, 12074, 13013
S. megistacrolobum 14172, 14173, 15619
S. megistacrolobum var. *toralapanum* 11914, 11960, 11963, 11964
S. raphanifolium 7573, 7609, 7610, 7612, 7615, 7619, 8333, 12040, 13563, 13569, 13572, 13575, 13577, 13579, 13604A, 13610, 3610A, 13612, 13625, 13626, 13641, 13652, 13654, 13695, 13704, 13705, 13709, 13721, 13728, 13735, 13755, 13759, 13775, 14296, 14298, 14299, 14302, 14318, 14346, 15125, 15628, 15699

PIURANA

S. cantense 14681

S. piurae 11615

TUBEROSA

S. ancophilum 12099

S. bukasovii 7715, 7717, 7820, 7953, 8083, 8692, 8845, 11292, 11293, 11844, 13115, 13116, 13166, 13168, 13171, 13194, 13538, 13542, 13543, 13576, 13600, 13602, 13676, 13680, 13694, 13713, 13715, 13796, 13798, 13858, 13859, 13862, 14333, 14381, 14383, 14404, 14407, 15304

S. bukasovii f. *multidissectum* 13110, 13524, 13581, 13720

S. candolleanum 11805, 11913, 14958, 14959, 15012

S. coelestispetalum 13690, 13716, 13717

S. goniocalyx 00001

S. leptophyes 13733

S. marinasense 13673, 13675, 13737, 13738, 13740, 15687

S. medians-2x 11259, 11637, 11884, 12046, 12047, 13185, 13268

S. mochiquense 14870

S. multiinterruptum 12057A, 14711, 14718

S. orophilum 13003

S. phureja 14460

S. sparsipilum 7611, 8358, 11893, 11911, 12030, 12035, 13564, 13588, 13644, 13697, 13774

S. tapojense 11821

S. tuberosum subsp. *andigena* 11828

S. wittmackii 11029

31. *Solanum sogarandinum* Ochoa, Agronomía, Lima 19:168-171, Figs. 3-5, 1954.

Figs. 153-158; Map 13; Plate XIV.

Plant generally acaulescent, rosette-forming or subrosette-forming (Figs. 153, 155), rosettes dense and compact, (8-)15-25(-40) cm in diam., with internodes (0.5-) 1.0-1.5 cm long at base, or caulescent and erect-decumbent with simple stems or branched (Fig. 154), robust, 15-25(-40) cm or more tall, with internodes 2.5-3.0 cm or more long; sparsely pilose, hairs white, multicellular, 1-3 mm long. Stolons 30-40 cm long, thick and fleshy, tubers round to ovoid, small, 1-2 cm in diam., white or pale brown, with numerous lenticels (Fig. 158). Leaves sparsely pilose above and somewhat less pilose below, (5.5-)9.0-16.0(-21.0) cm long by (2.5-)3.0-7.5(-8.5) cm wide, simple or imparipinnate, with (0-)1-3(-4) pairs of lateral leaflets, without interjected leaflets, petioles 1-3 cm long. Terminal leaflet much larger than the laterals, (4-)6-10(-12) cm long by (2.5-)3.0-5.0(-5.5) cm wide, broadly elliptic to ovate-elliptic, apex broadly attenuate to obtuse or slightly pointed, base cuneate and narrowly decurrent about the petiolule. The first upper pair of lateral leaflets (1.0-)2.0-4.5(-5.5) cm long by (0.5-)1.0-2.0(-3.0) cm wide, ovate to ovate-elliptic, apex obtuse, base conspicuously decurrent about

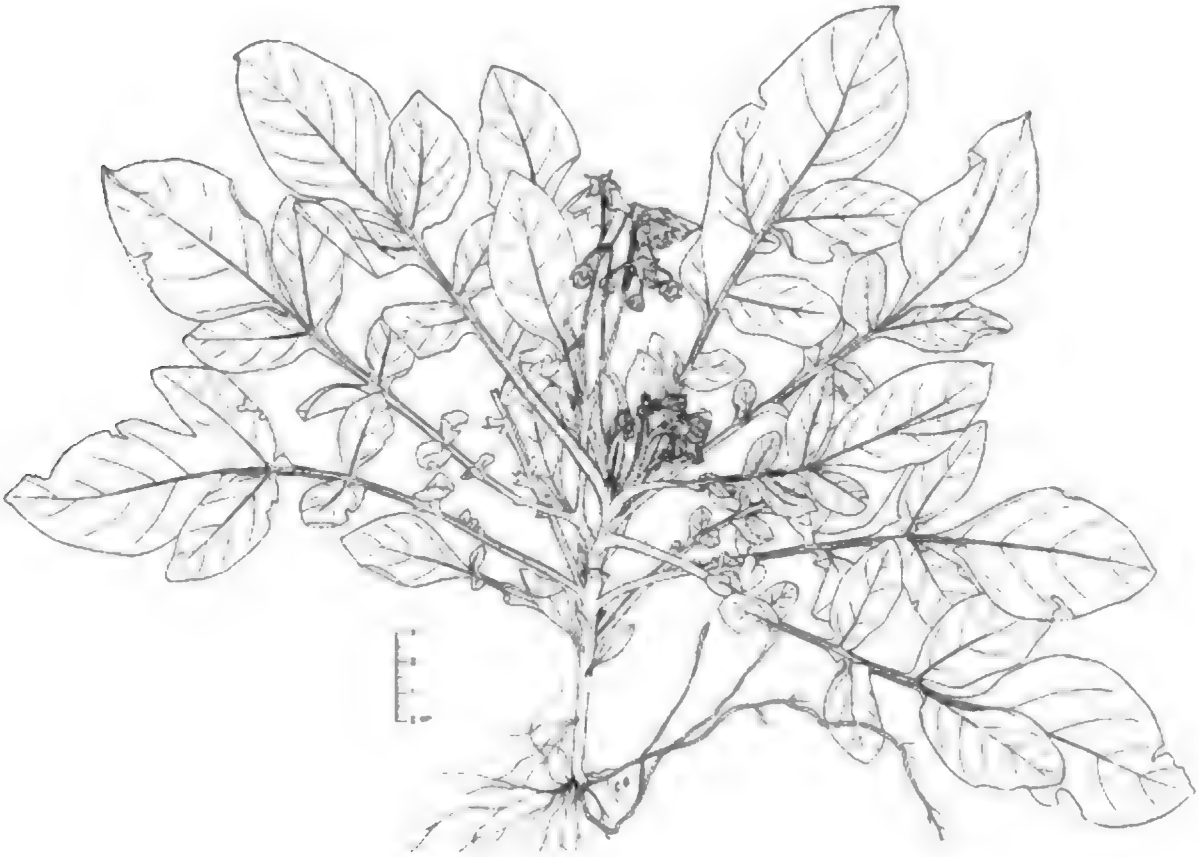


Figure 153. *Solanum sogarandinum* (*Ochoa 1440,* holotype).

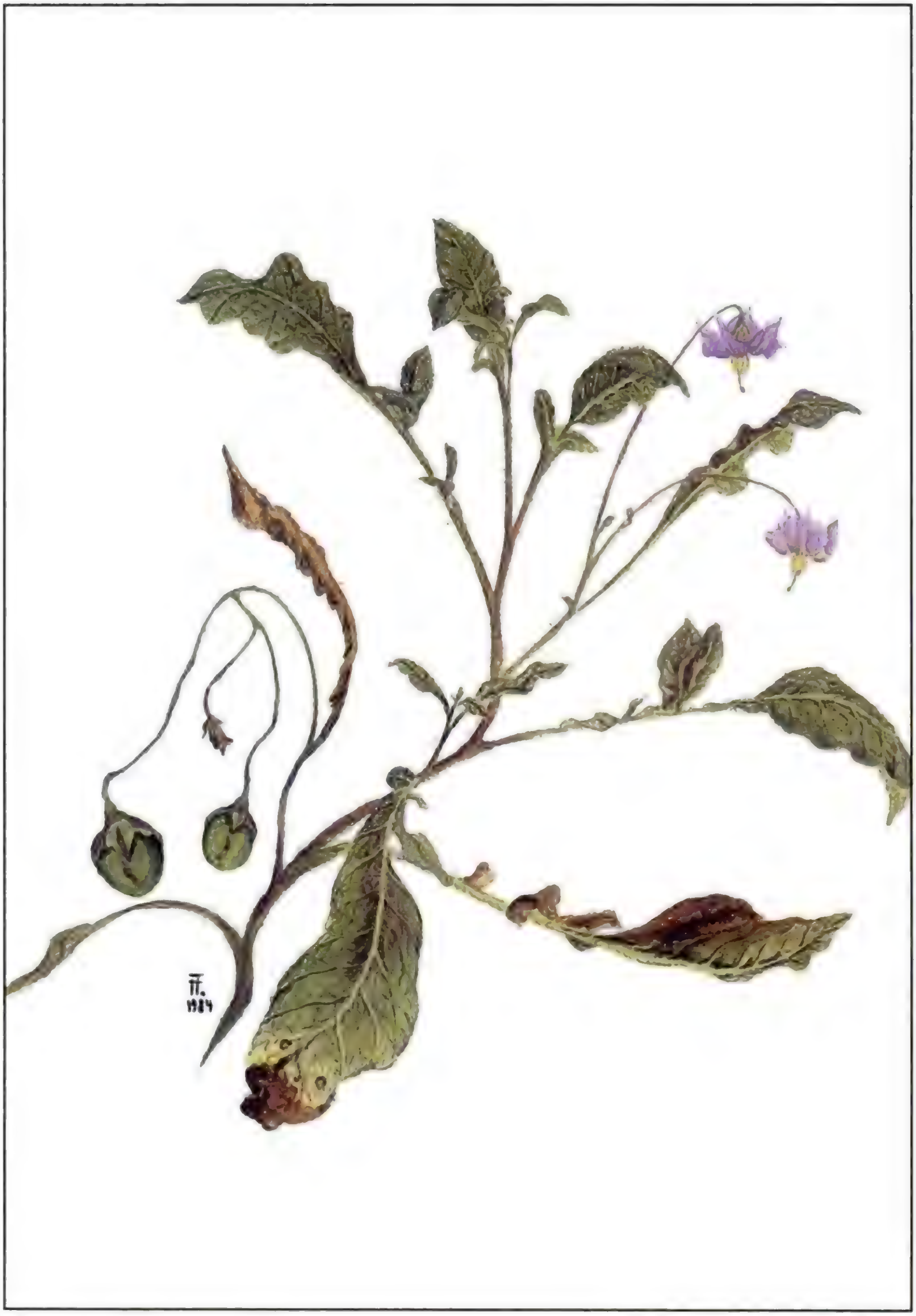


Plate XIV. *Solanum sogarandinum* Ochoa.

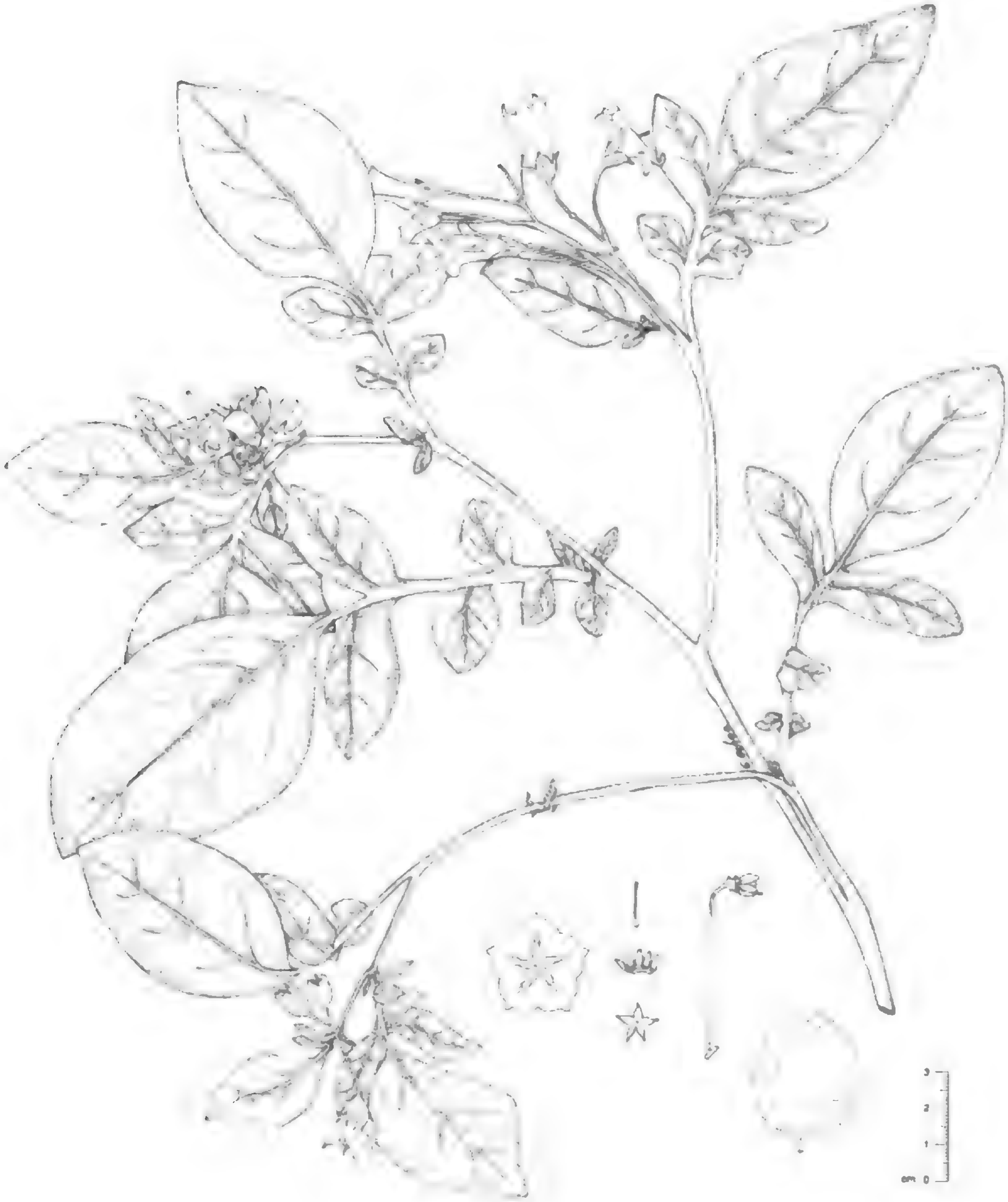


Figure 154. Caulescent plant type of *Solanum sogarandinum* (*Ochoa 2631*).

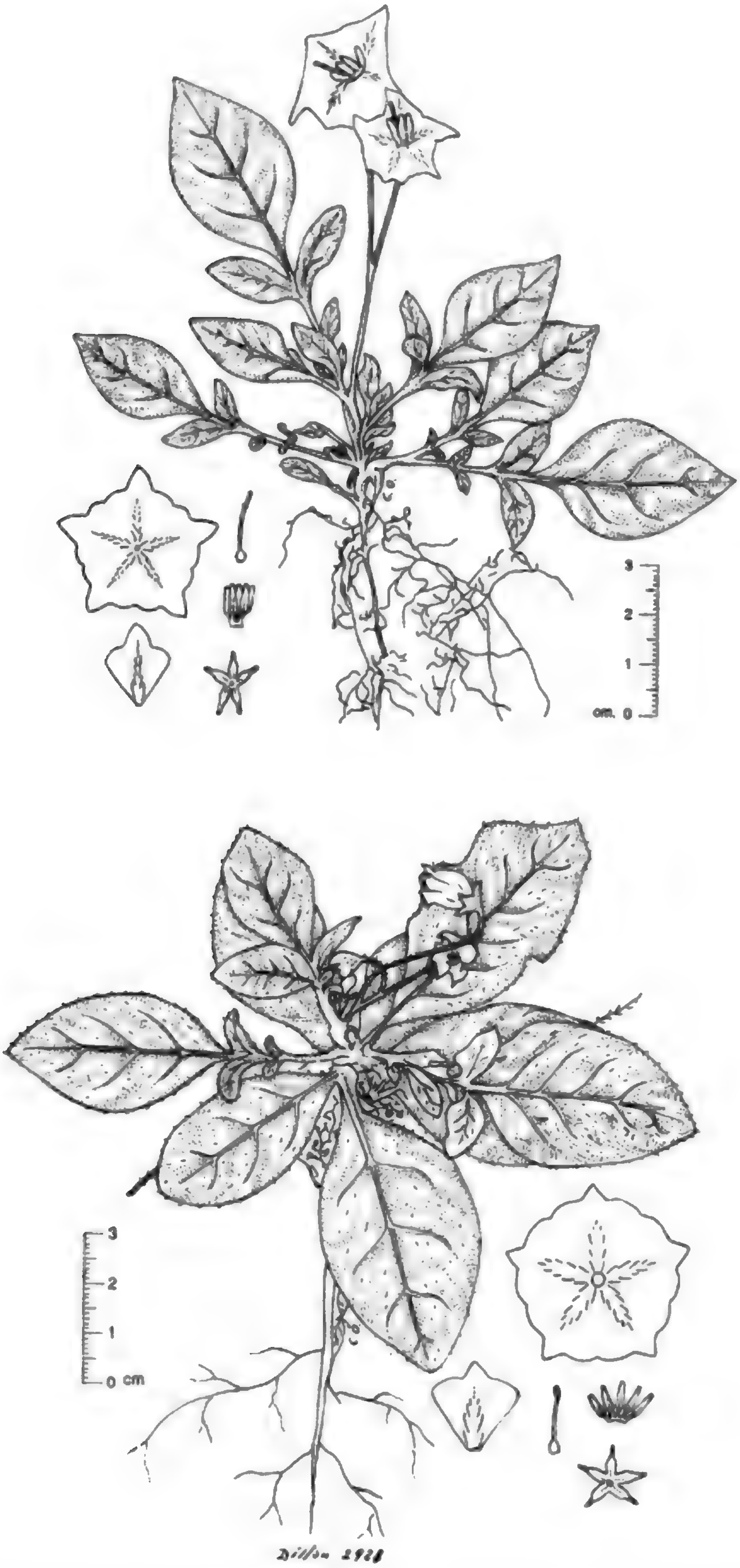


Figure 155. *Solanum sogarandinum*. Top: subrosette (*Ochoa and Salas 12540*). Bottom: rosette (*Dillon et al. 2928*).

the rachis; lateral leaflets of the second upper pair and following pairs, when present, diminishing gradually in size toward the base, sessile and somewhat more narrowly decurrent, larger than the leaflets of the first upper pair. Pseudostipular leaves lacking, obsolescent or extremely small. Inflorescence terminal or pseudoterminal, (4-)6-10-flowered. Peduncle short, 1-3 cm long, occasionally 6 cm long and bracted, pilose; pedicels (1.5-)2.5-4.0 cm long, pilose, articulated 5-7 mm below the base of the calyx. Calyx 6-7 mm long, pilose, greenish or slightly pigmented, lobes ovate-lanceolate, very shortly acuminate. Corolla rotate, 3 cm in diam., bluish or pale bluish-purple, lobes and acumens short, acumens white, densely pubescent margins, externally very sparsely and shortly pilose from the tip of each acumen down to the petal base. Anther column elliptic or subellipsoid; anthers ovate-lanceolate, small, 4.5-4.8 mm long by 2.5 mm wide at base; filaments short, less than 1 mm long, glabrous. Style short and thick, 8 mm long, exserted 2.5 mm, papillose and pubescent with short setose hairs along the lower two-thirds of its length; stigma subellipsoid, small. Fruit round, 1.5 cm long, light green, marked with vertical light brown streaks (Fig. 157). Chromosome number 2n=24 and 2n=36. EBN=2.

Local name: *Papa de Zorro*.

Type: PERU. Department La Libertad, Province Santiago de Chuco, Sogaranda, 3550 m alt., 12 May 1952, *C. Ochoa 1440* (holotype OCH, isotype CIP).

Affinities

This species is closely related to *S. megistacrolobum*. The two are very similar in their habit (rosette-forming or occasionally with an elongated and weakly erect-decumbent stem), coarse, sparse pubescense that covers the entire plant, and decurrent lateral leaflets. However, this species can be readily told apart from *S. megistacrolobum* by its persistent and more divided leaves, its vigorous and more pubescent peduncle, and by its essentially rotate corolla.

Habitat and Distribution

Although this species grows in the high Andes of Peru at elevations from 3000 to 4050 m, the majority of its populations are probably concentrated between 3500 and 3900 m. It occurs commonly in the grasslands and rocky slopes of *jalca* formations or along the edges of woody thickets dominated by *Polylepis sericea* and *Buddleja incana*.

Its distribution encompasses the departments of Ancash, Huánuco, La Libertad and Cajamarca in northern Peru, extending from the jalcas of Llipa in the province of Bolognesi (ca. 10°33' S and 77°13' W) to jalcas in the vicinity of Cumbemayo in the southwestern part of the department of Cajamarca (07°09' S and 78°31' W) (Map 13).

Specimens Examined

Department Ancash

Province Aija: Cancha Uchucuna, 3800 m alt., facing Tacarpo in the jalcas of Huayán, 2 May 1972, *C. Ochoa 3305* and *3306* (OCH). Above Tacarpo, 3900 m alt., between Cancha Uchucuna and Huarmán, jalcas of Huayán, 2 May 1972, *C. Ochoa 3308* (OCH). Sequi Pocyan, 4000-4050 m alt., above the water source of Huarmán, jalcas of Huayán, 2 May 1972, *C. Ochoa 3313*, 2n=24 (OCH), and *3314* (OCH). Monserrate, 3075 m alt., at the lower end of Aija, near the banks of the Monserrate-Aija River, amid cactus, n.v. *Atocpa papan*, the berries are called *Lancusha*, 22 March 1979, *C. Ochoa 13235*, 2n=36 (CIP, MOL, OCH, US, USM). Slope of Romero Jata, on Cerro Ckellecuani, 3800 m alt., on the footpath from Mallqui to Huarmán, 26 April 1983, *C. Ochoa 15191* (CIP, OCH, USM).

Province Bolognesi: Camasichiqui, 3450 m alt., above Oncoy, near Ocros and Raján, 20 March 1978, *C. Ochoa and A. Salas 12058*, 2n=36 (CIP, MOL, OCH, USM). Jalcas de Llipa, vicinity of Llipa Mine, 3600 m alt., near Raján, 20 March 1978, *C. Ochoa and A. Salas 12061*, 2n=36 (CIP, GH, MO, MOL, OCH, US, USM). Ruqui Aliso, 3200 m alt., 2 km east of Quisipata and facing Chichoj, among trees of *Schinus molle* in stony soils, berries round, 1 May 1984, *C. Ochoa 15723*, 2n=24 (CIP, MOL, OCH, US, USM).

Province Huaraz: Huascarán National Park, Shallap quebrada (77°24' W, 09°30' S), 3700-4000 m alt., brushfields, including some small trees (*Polylepis sericea* and *Buddleja incana*), very large boulders, bottom and lower slopes, 22 May 1985, *D.N. Smith, R. Valencia and A. Gonzales 10717* (MO).

Province Huari: 1 km beyond San Marcos, 3900 m alt., on the San Marcos-San Luis road, in the foothills of the mountain, berries round, large, 10 May 1978, *C. Ochoa 13013A*, 2n=24 (CIP, GH, MO, MOL, OCH, US, USM, from plants grown in the greenhouse at Huancayo).

Province Pallasca: Above the Pasto Bueno Mine, 3550 m alt., in *jalca* grassland, 17 February 1961, *C. Ochoa and F. de la Puente 2345* (OCH). Near Pahuas, 3650 m alt., on the Sihuas-Conchucos road, plants senescent, only tubers were collected, 4 June 1963, *C. Ochoa 2535*, 2n=24 (MOL, OCH, USM, from plants grown at the Universidad Nacional Agraria La Molina, Lima). Jalcas de Acrana, 3700 m alt., between Conchucos and Chaquicocha, tubers and berries were collected, 8 June 1963, *C. Ochoa 2542*, 2n=24 (OCH, from a plant grown in the

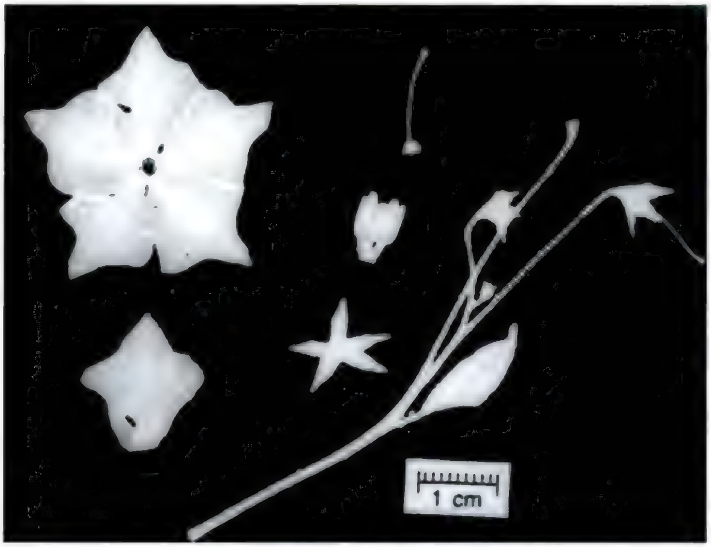


Figure 156. Floral dissection of *Solanum sogarandinum* (*Ochoa 12540*).

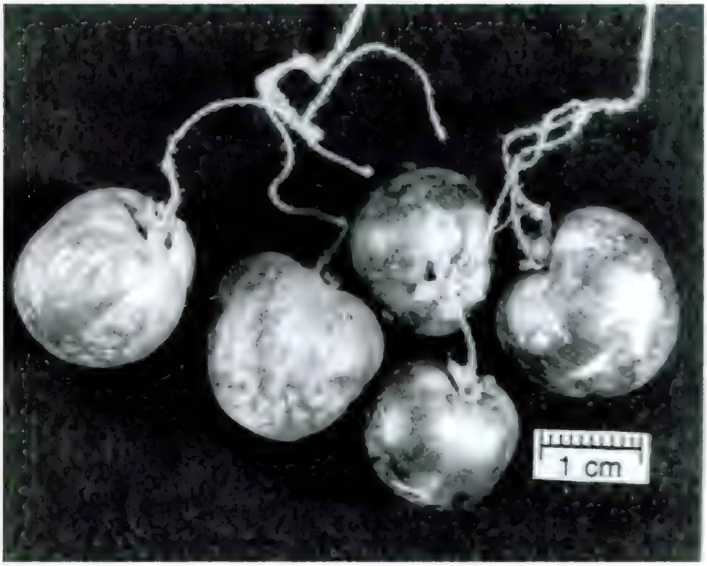


Figure 157. Fruits of *Solanum sogarandinum* (*Ochoa 13324*).

material

greenhouse at the Universidad Nacional Agraria La Molina, Lima), *2544* (OCH, from originally collected plant) and *2544A* (MOL, OCH, USM, from plants grown in the greenhouse at La Universidad Nacional Agraria La Molina, Lima). Acrana, near Conchucos, 3500 m alt., 3 February 1964, *C. Ochoa S-54*, 2n=24 (= *PI-365360*) (WIS).

Province Pomabamba: Heights of Pomabamba, 3300 m alt., plants small, 15-20 cm tall, flowers blue, February 1960, *C. Ochoa 2279* (MOL, OCH, US, USM). Chontabamba, ca. 3700 m alt., in grassland along the Sihuas-Pomabamba road, 2 June 1963, *C. Ochoa 2528* (OCH). Jalcas de Sicsibamba, 3700 m alt., between Sihuas and Pomabamba, only tubers were collected, 2 June 1963, *C. Ochoa 2530*, 2n=24 (GH, MOL, OCH, US, USM, from plants grown at the Universidad Nacional Agraria La Molina, Lima). Chalhuacocha, 3700 m alt., on the Sihuas-Conchucos road, 19 June 1963, *C. Ochoa 2545*, 2n=24 (MOL, OCH, USM).

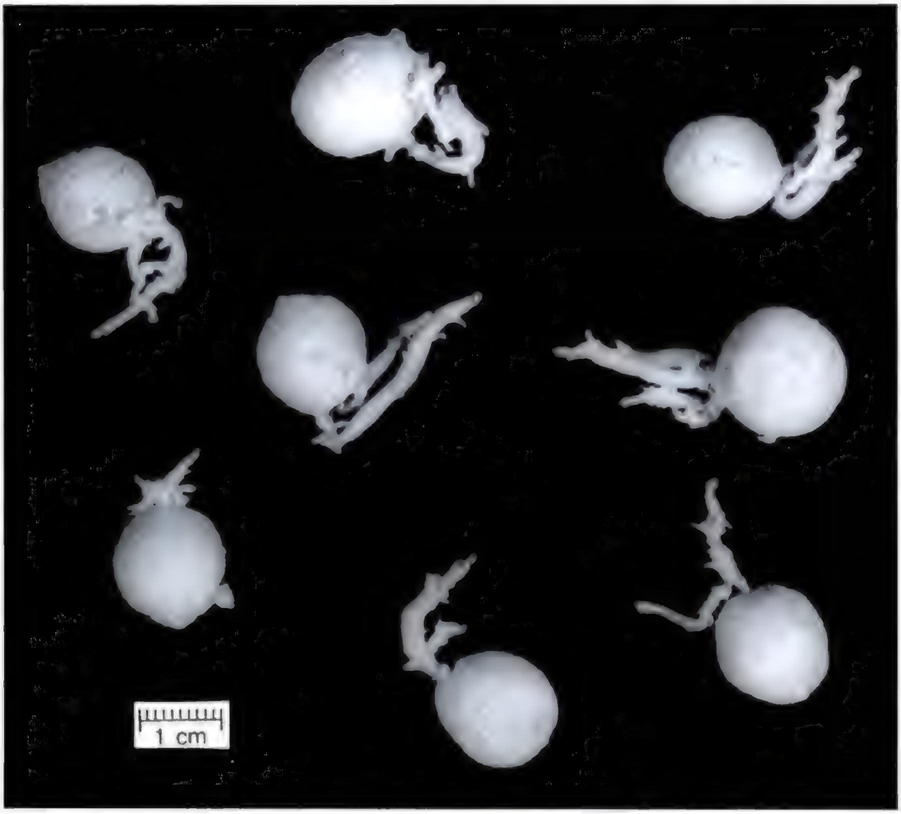


Figure 158. Tubers of *Solanum sogarandinum* (*Ochoa 13336*).

Province Sihuas: Cerro Huinjirca, 3350 m alt., about 7 km past Huayllabamba on the Sihuas-Santa Clara road, 7 May 1978, *C. Ochoa 13006*, 2n=36 (CIP, GH, MO, MOL, OCH, US, USM, from plants grown at Huancayo).

Department Cajamarca

Province Cajamarca: Ca. 14 km southwest of Cajamarca on road to Cumbemayo (Aqueduct and stony forest), ca. 3550 m.alt., herb to 15 cm, flowers purple, anthers yellow, roots with small tubers, 12 January 1983, *M. Dillon, U. Molau and P. Matekaitis 2928* (OCH, US). Chicos, 3500 m alt., in grassland, plant rosette-forming, small, very scarce, April 1978, *C. Ochoa and A. Salas 12539*, 2n=24 (OCH). Jalcas de Chicos, 3500 m alt., small plant with very short stem, scarce, April 1978, *C. Ochoa and A. Salas 12540* (OCH).

Department Huánuco

Province Dos de Mayo: Algaihuachanan, 3750 m alt., Distr. Chavinillo, 5 May 1961, *C. Ochoa 2375* (OCH). Cerro Sollacaca, 3800 m alt., Tantas Ranch, above Quivilla, between Quivilla and Jacas Grande, 21 April 1967, *C. Ochoa 2631* (MOL, OCH, USM). Jalcas of Algaihuachanan, 3750 m alt., near Pariapampa in the Distr. Chavinillo, May 1972, *C. Ochoa 3648* (OCH, from plants grown at the Granja K'ayra, 3200 m alt., Cusco).

Province Huamalíes: Punas of Condor-ismay, 3900 m alt., in heights of Tantamayo, 25 April 1967, *C. Ochoa 2641* (OCH) and *2641A* (MOL, OCH, from plants grown at San Mateo, 3300 m alt., east of Lima, January 1968). Rocky foothills of Cerro Huanca, near Jacas, 3760 m alt., only tubers, May 1972, *C. Ochoa 3649* (OCH, from plants grown at the Granja K'ayra, 3200 m alt., Cusco). Jalcas or punas of Cacho Cruz, 3650 m alt., on the bridle path from Tantamayo to Monzón, only mature berries were collected, May 1972, *C. Ochoa 3670*, 2n=24 (OCH, from plants grown at the Universidad Nacional Agraria La Molina, Lima).

Department La Libertad

Province Pataz: Jalcas de Gachil, 3700 m alt., on the bridle trail from Tayabamba to Urpay, 7 May 1978, *C. Ochoa 13324*, 2n=24 (OCH), and *13324A* (CIP, MOL, OCH, USM, from plants grown in the greenhouse at Huancayo). Blanca Murococha, 3600 m alt., on the bridle trail from Palo Seco to Huarimarca, heading down the jalcas of Tauli, in grassland, 7 May 1979, *C. Ochoa 13336*, 2n=24 (CIP, OCH).

Province Sánchez Carrión: Jalcas de Huaguil, 3550 m alt., about 7 km northeast of Huaguil, growing near *S. chomatophilum* and large colonies of *Calceolaria weberbaueriana*, in grassland and steep mountain slopes, 30 April 1979, *C. Ochoa 13293*, 2n=24 (CIP, OCH).

Province Santiago de Chuco: Sogaranda, 3550 m alt., about 8 km before Santiago de Chuco, 12 May 1952, *C. Ochoa 1440* (CIP, OCH, type collection of *S. sogarandinum*), *1440.2* and *1440.5* (OCH, from plants grown at Sturgeon Bay, Wis., USA, 30 August 1955, from seeds corresponding to the type collection *OCH-1440*). Huayatán, 3650 m alt., on the Huamachuco road heading toward Sogaranda, 21 May 1963, *C. Ochoa 2506* (MOL, OCH, from plants grown at the Universidad Nacional Agraria La Molina, Lima). Huachapa, 3000 m alt., near Angasmarca, 25 May 1963, *C. Ochoa 2515* (MO, MOL, OCH, US, USM, from plants grown at the Universidad Nacional Agraria La Molina, Lima, December 1963). Cushpinga, ca. 3600 m alt., Hacienda Angasmarca, 30 January 1968, Leg. *Bernardino Martell s.n.* (OCH). Jalcas of San José, 3500 m alt., near Cachicadán, only tubers, May 1971, *C. Ochoa 3042* (OCH, from plants grown at the Universidad Nacional Agraria La Molina, Lima).

Breeding Potential

Solanum sogarandinum has diploid (2n=24) and triploid (2n=36) forms, and is essentially self-sterile.

Unilateral crosses of this species with *S. megistacrolobum*, to which it is closely related, are easily accomplished, as are reciprocal crosses with *S. megistacrolobum* var. *toralapanum*. Triploid clones of *S. sogarandinum* can be used as pistillate parents in crosses with *S. megistacrolobum* var. *toralapanum*, *S. medians* var. *autumnale*-2x (to which it is also related), *S. bukasovii*, *S. chomatophilum* and *S. tuberosum* subsp. *andigena*. However, although the berries from these crosses generally contain few seeds, those that do develop usually have well-formed embryos.

Solanum sogarandinum is also compatible in reciprocal crosses with *S. medians* var. *autumnale*-2x, *S. bukasovii*, *S. bukasovii* f. *multidissectum*, *S. jalcae*, *S. multiinterruptum*, *S. orophilum*, *S. chomatophilum* and *S. acaule*. The highest average number of seeds produced per berry (up to 182) was obtained in reciprocal crosses with *S. medians* var. *autumnale*-2x. Because *S. sogarandinum* may have played a role in the origin of *S. albicans* (see comments under this species), it is important to compare the results of the experimental crosses of *S. sogarandinum* with *S. chomatophilum* and *S. acaule* (see Table 39).

Reciprocal crosses of *S. sogarandinum* with *S. huarochiriense* or *S. goniocalyx* were successful only when this species was used as the pistillate parent. Compatibility was also found in unilateral crosses of *S. sogarandinum* with *S. raphanifolium* and S. *alandiae*. Lastly, despite the differences in endosperm balance number (EBN) between *S. sogarandinum* and *S. dolichocremastrum*, this did not seem to hinder the making of reciprocal crosses between the two.

Table 39. Fertility of *Solanum sogarandinum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note following Table 1 for further explanation.

2n	EBN	Series	Species	FL	TB	SB
Crosses involving diploid (2n=24) *S. sogarandinum*						
24	1	Megistacroloba	× *S. dolichocremastrum*	26(15)	13(5)	53(8)
24	1	Tuberosa	× *S. immite*	7(5)	0(1)	0(0)
24	2	Conicibaccata	× *S. chomatophilum*	12(68)	3(36)	2(42)
24	2	Ingaefolia	× *S. jalcae*	9(16)	4(15)	85(44)
24	2	Megistacroloba	× *S. megistacrolobum*	12	11	44
			× *S. megistacrolobum* var. *toralapanum*	11(2)	7(2)	81(50)
			× *S. raphanifolium*	7	7	31
24	2	Tuberosa	× *S. ancophilum*	3(7)	0(1)	0(0)
			× *S. bukasovii*	101(147)	71(83)	37(77)
			× *S. bukasovii* f. *multidissectum*	4(17)	4(9)	12(50)
			× *S. goniocalyx*	3(13)	1(10)	8(0)
			× *S. huarochiriense*	11(18)	11(15)	75(0)
			× *S. medians* var. *autumnale*-2x	13(22)	9(14)	182(10)
			× *S. multiinterruptum*	19(6)	11(1)	18(4)
			× *S. orophilum*	4(24)	2(8)	15(98)
48	2	Acaulia	× *S. acaule*	7(376)	4(344)	43(74)
Crosses involving triploid (2n=36) *S. sogarandinum*						
24	1	Lignicaulia	× *S. lignicaule*	2	2	0
24	2	Conicibaccata	× *S. chomatophilum*	11	9	6
24	2	Megistacroloba	× *S. megistacrolobum* var. *toralapanum*	12	8	4
			× *S. raphanifolium*	5	0	0
24	2	Tuberosa	× *S. alandiae*	2	2	8
			× *S. bukasovii*	28	22	5
			× *S. medians* var. *autumnale*-2x	6	6	7
48	4	Tuberosa	× *S. tuberosum* subsp. *andigena*	11	5	4
72	4	Acaulia	× *S. albicans*	4	3	0

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 40. Collections (OCH) used in *S. sogarandinum* fertility studies.

a. With *S. sogarandinum*-2x:

ACAULIA

S. acaule 10112, 11322, 11823, 11825, 11826, 11829, 11830, 11831, 11832, 11833, 11860, 11867, 11887, 11889, 11890, 11891, 11895, 11910, 11910A, 11912, 11961, 11965, 11979, 11989, 12033, 12037, 12056, 12069, 12073, 12092, 13005, 13149, 13172, 13192

CONICIBACCATA

S. chomatophilum 11061, 11753A, 11856, 13208, 13210, 13341

INGAEFOLIA

S. jalcae 13344

MEGISTACROLOBA

S. dolichocremastrum 12074, 13013
S. megistacrolobum 14272, 15619
S. megistacrolobum var. *toralapanum* 11914, 13544
S. raphanifolium 7610
S. sogarandinum 13006, 13293, 13324, 13336

TUBEROSA

S. ancophilum 12099
S. bukasovii 11058, 11300, 11306, 11330, 11861, 11872, 11875, 11876, 13000, 13113, 13116, 13124, 13166, 13171, 13195, 13275, 15202
S. bukasovii f. *multidissectum* 11843, 13110, 13182
S. goniocalyx 00001
S. huarochiriense 11331, 14525,
S. immite 14491
S. medians-2x 11637, 13264
S. multiinterruptum 11693, 12066, 14718
S. orophilum 12077, 12080, 12082, 12095

b. With *S. sogarandinum*-3x:

ACAULIA

S. albicans 12081A, 12091

CONICIBACCATA

S. chomatophilum 13292, 13307

LIGNICAULIA

S. lignicaule 11317

MEGISTACROLOBA

S. megistacrolobum var. *toralapanum* 11960, 13544
S. raphanifolium 15629
S. sogarandinum-3x 11954, 11960, 12058, 12061, 12099

TUBEROSA

S. alandiae 12014
S. bukasovii 11306, 11330, 13163, 13857, 13858, 15202
S. medians-2x 11637, 12047
S. tuberosum subsp. *andigena* 12076

SERIES OLMOSIANA

OLMOSIANA Ochoa, An. Cien. Univ. Agraria, Lima 3(1):33, 1965.

Plants herbaceous, stoloniferous and tuber-bearing. Leaves imparipinnate with a broadly winged rachis. Corolla deeply stellate with narrowly-lanceolate lobes, creamy-white or creamy-yellow. Fruit ovoid. A monotypic series.

Distribution

Endemic to Peru and Ecuador. So far as is presently known, the single species of this series is restricted in distribution to the small relic patches of natural vegetation that still remain in the area northwest of Olmos, formerly Paso de Porculla, Department of Lambayeque in northern Peru and in the vicinity of Chilla, Province of El Oro in southern Ecuador near the Peruvian border.

32. *Solanum olmosense* Ochoa, An. Cien. Univ. Agr., Lima, 3(1):35-37, illustr., 1965.

Figs. 159-164; Map 12; Plate XV.

Plant robust, erect to erect-decumbent, 40-50(-70) cm tall, glabrous. Stem simple or branched, winged, 4-5(-7) cm in dia. at base, with internodes 2-4(-6) cm long. Plant stoloniferous and tuber-bearing; stolons 1.20 m long, slender, 1.5-2.5 mm in dia.; tubers round to ovoid or fusiform, white, small, 1-3(-5) cm long, with smooth hairless periderm (Fig. 161). Leaves imparipinnate, glabrous, (10.0-) 15.0-17.0 cm long by (7.0-)10.5-12.5 cm broad, dark green above and lighter green below, with (1-)2(-3) pairs of lateral leaflets and a broadly winged rachis,

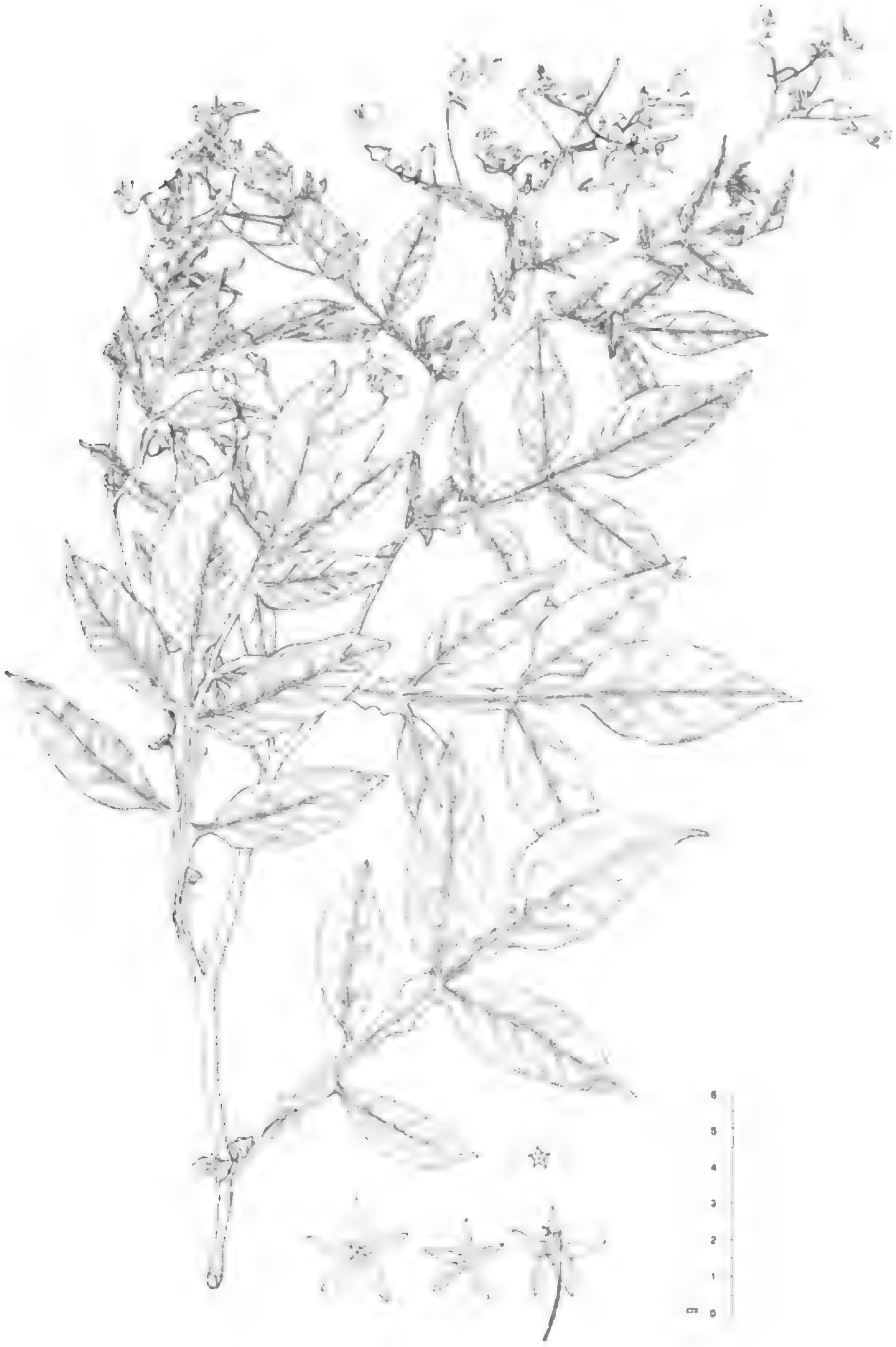


Figure 159. *Solanum olmosense* (*Ochoa 2473*, holotype).

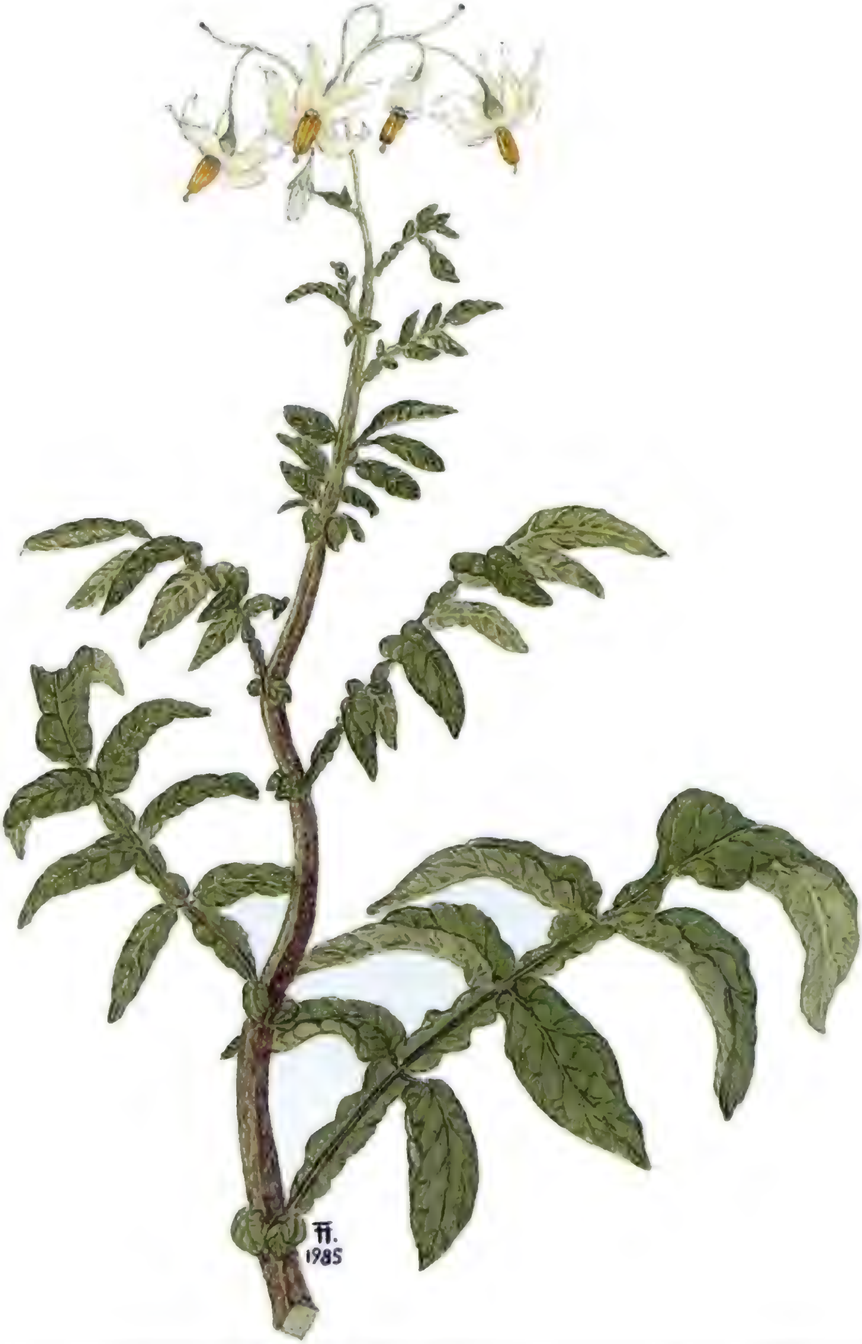


Plate XV. *Solanum olmosense* Ochoa.

the latter with irregularly broad and gently waving margins and 1-2 pairs of inconspicuous or rudimentarily-formed interjected leaflets, on broadly winged petioles 2.5 cm long. Leaflets elliptic-lanceolate to broadly elliptic-lanceolate or ovate-attenuate; terminal leaflet slightly larger and broader than the first pair of lateral leaflets, (5-)6-7 cm long by (3-)4-5 cm broad, the apex acuminate and the base broadly cuneate and narrowly decurrent upon the rachis; lateral leaflets either very shortly petiolulate or sessile and decurrent, forming broad wings along the length of the rachis; interjected leaflets irregularly formed, inconspicuous or little distinguishable from the wavy margins of the rachis. Pseudostipular leaves broadly falcate to suborbicular or clasping, 5-10 mm long by 4-6 mm broad. Inflorescence terminal and lateral, cymose or cymose-paniculate, 8-12 (-16)-flowered (Fig. 162); peduncle short, 2-4 cm long, slender, 1.5-2.0 cm in dia. at base, glabrous like the pedicels and the calyx; pedicels 20-30(-40) mm long, slender, articulated 5-6 mm below the calyx. Calyx very small, 3.5-4.5 (-5.0) mm long, lobes very short, ovate to subquadrate, the apex apiculate. Corolla deeply stellate, reflexed, small, 1.5-2.0(-2.5) cm in dia., creamy-white or cream with a yellowish-green internal star, lobes narrowly lanceolate, 8-10 mm long by 3.0-3.5 mm broad at base, with inconspicuous acumens and cucullate and pubescent apices (Fig. 160). Anthers narrowly lanceolate, (5-)6-7 mm long; filaments very short, much less than 1/2 mm long, glabrous. Style 9.5-10.5 mm

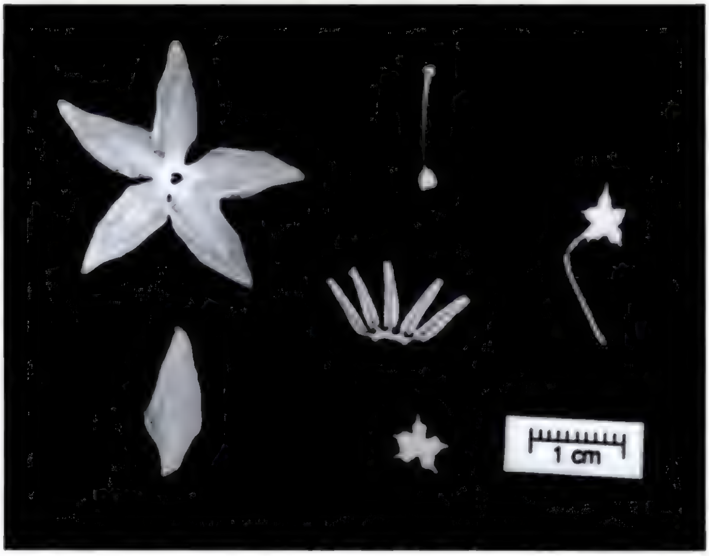


Figure 160. Floral dissection of *Solanum olmosense* (*Ochoa 2473*, holotype).

long, exerted 3-4 mm, glabrous; stigma ovate-claviform. Fruit ovoid to pyriform, 1.5-2.0 cm long, pure green or green sprinkled with whitish dots, not verrucose. Chromosome Number: 2n=24. EBN=1.

Local name: *Papa de Zorro* (or Fox Potato).

The writer was informed by the natives of the region of Olmos that the tubers and flowers of this wild potato species are sometimes used in popular medicine as a remedy for heart conditions.

Type: PERU. Department and Province of Lambayeque, right bank of the Olmos River near El Sauce, 1640 m alt., formerly Paso de Porculla, along the Olmos-Jaén road, 3 April 1963, *C. Ochoa 2473* (holotype OCH, isotypes F, GH, MO, MOL, P, USM, US).

In the original diagnosis of *S. olmosense*, reference was made to the fact that the tubers of this plant are pubescent. However, this appears to be true of only the very immature tubers, i.e., at the time of their initial formation. Afterwards, as confirmed by the writer's more recent observations of this plant in nature (including at its type locality, the Olmos Quebrada in Peru and the site of Tabla Rumi in Ecuador), the skin turns smooth and glabrous.

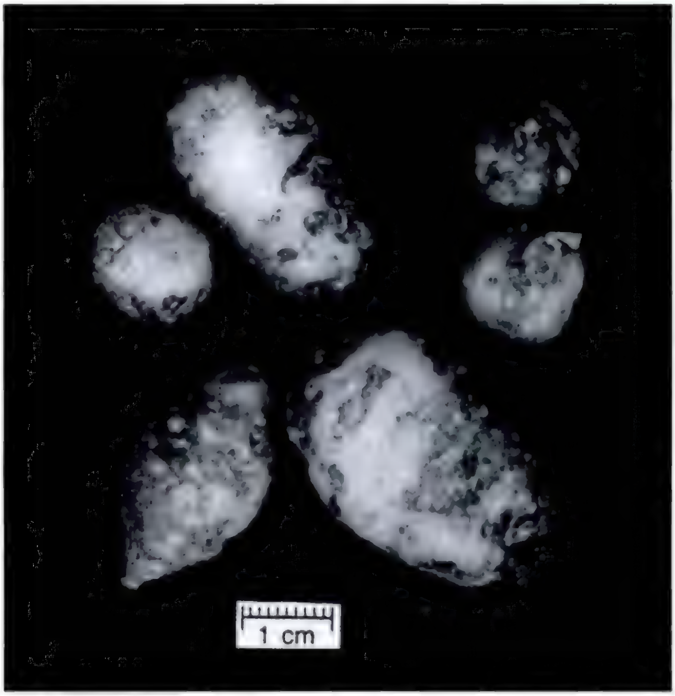


Figure 161. Tubers of *Solanum olmosense* (*Ochoa 13348*).

From our observations of this species in nature, it would appear that it is resistant to such insect pests as *Epitrix* and *Empoasca*, and especially to the potato moth, *Phthorimaea operculella*.

Affinities

This species appears to be related to *S. yungasense* by virtue of its stellate, creamy-white corolla and small, apiculately-lobed calyx. However, the two species differ markedly from one another with respect to leaf shape and the nature of their fruits.

S. olmosense also shares some features in common with *S. raquialatum*. Both have very similar leaves, though florally and genetically they are very different. Reciprocal crosses of *S. raquialatum* with *S. olmosense*, for example (see Table 31), are for the most part successful only when *S. olmosense* is used as the staminate parent.

According to Dr. Matzubayashi (Personal communication), the genomes of *S. olmosense* are indeed very different from those of *S. raquialatum*. Moreover, his meiotic studies of chromosome pairing in the following diploid hybrid combinations all suggest that we are dealing basically with good taxonomic species: *S. olmosense* × *S. abancayense*, *S. raquialatum* × *S. chomatophilum*, and *S. raquialatum* × *S. olmosense*.

Habitat and Distribution

This species grows characteristically in thickets of trees and shrubs with an understory of herbaceous plants. It occurs frequently with the resinous trees *Murcera graveolens* and *Lafoensia acuminata*, and with *Spondias lutea*, *Erytrina*, *Tecoma*, *Salix*, *Monnina*, *Ipomoea carnea* (= borrachera), *Caparis angulata* (= zapote), *Cordia capitata*, *Amaranthus*, *Cantua quercifolia*, *Desmodium uncinatum*, *Paspalum lineispatha*, *Calceolaria pavonii*, *Sida rhombifolia*, *Amicia gladulosa*, *Iresine diffusa*, *Browalia americana* and *Salvia squalens*. In the highlands near Paso de Porculla (2140 m), this species grows with *S. huancabambense*, another wild tuber-bearing species.

So far as known, *S. olmosense* is found only in the following two widely separated ecological niches: 1) In the relic vegetation of the Quebrada de Olmos (1640 m alt.), which actively continues today its process of erosion (Fig. 164); and, 2) In the shrub thickets of Tabla Rumi near Celica (ca. 2500 m alt.), Province of Loja, Ecuador, a region where the natives call this species "Papa Chihua." The first area is located at 5° 57' S and 79° 35' W; while the second is situated at 4° 01' S and 81° 38' W.

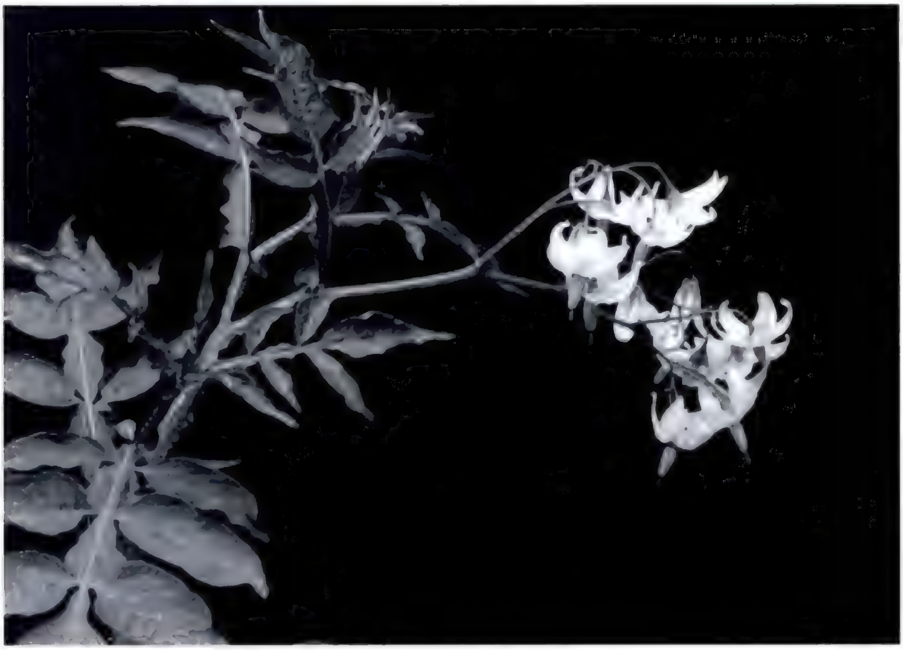


Figure 162. Inflorescence, leaves and flowers of *Solanum olmosense*.

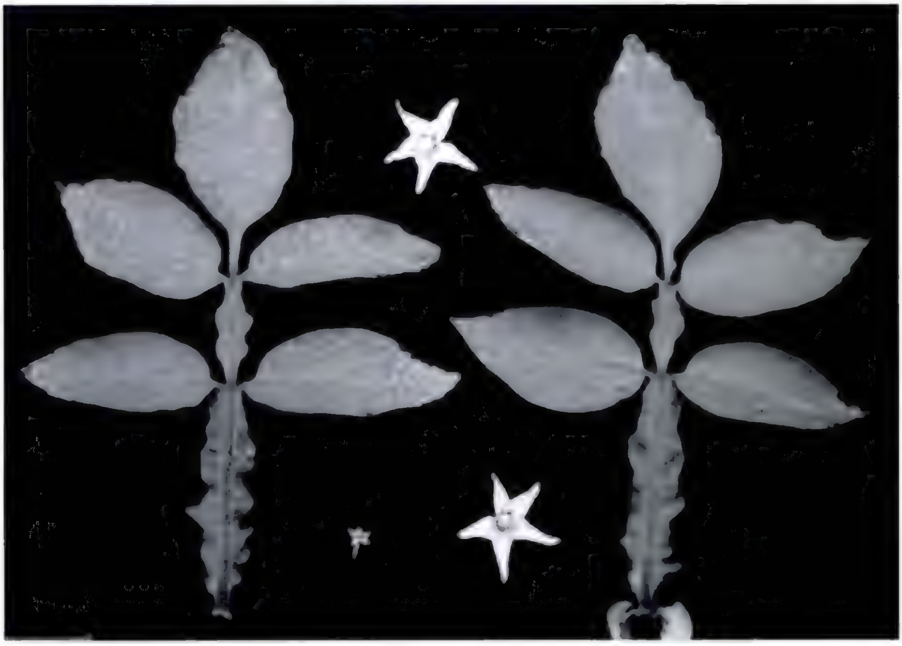


Figure 163. Leaves and flowers of *Solanum olmosense*.

Specimens Examined

Department Lambayeque

Province Lambayeque: Right bank of the Olmos River, near El Sauce, 1640 m alt., a few km along the Olmos-Porculla-Jaén road, 3 April 1963, *C. Ochoa 2473*, 2n=24 (F, GH, MO, MOL, OCH, P, USM, US, type collection of *S. olmosense*). Abra Porculla, 1570 m alt., west side, 38.6 km E. of Olmos-Marañón hway, herb to 1.1 m., petals cream-white with pale green base, anthers orange-yellow, subsurface runners, 18 March 1964, *P.C. Hutchison and J.K. Wright 4430* (F, UC, US, USM). Heading up from Olmos to Porculla, 1850 m alt., among scrub and herbs and in low rain forest near the talus slopes of the road, amid shrubs of *Lafoensia acuminata*, *Bursera graveolens* and *Cestrum* sp., 31 March 1964, *C. Ochoa and J.G. Hawkes 2571* (CIP, F, GH, MOL, OCH, US).

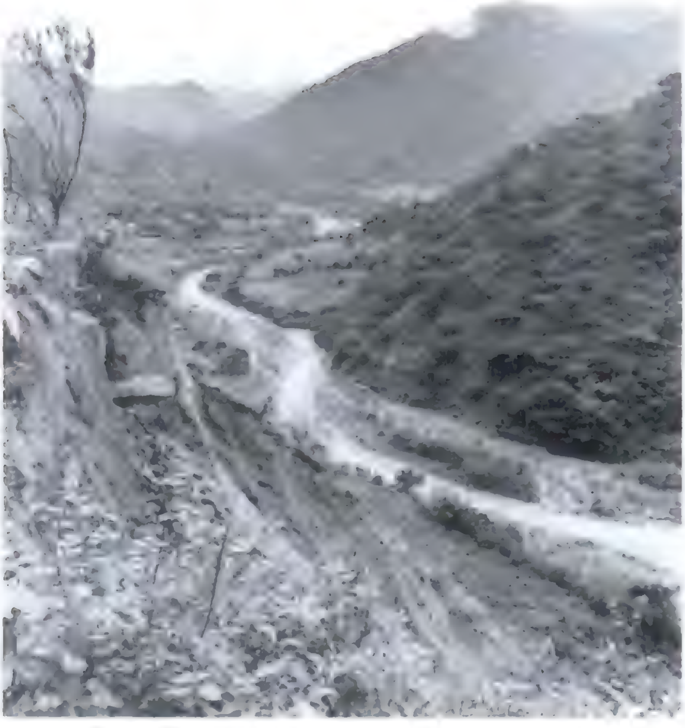


Figure 164. Habitat of *Solanum olmosense* in the much eroded valley of the River Olmos (April 1992).

ECUADOR

Province El Oro: Near Tablarumi, 2650 m alt., 3 hours walking from Celica, 19-20 May, 1979, C. *Ochoa 13348* (CIP, OCH).

Breeding Potential

The results of crosses of *S. olmosense* with diploid (2n=24) species of EBN=1 and EBN=2, tetraploids (2n=48) of EBN=2 and EBN=4, and hexaploids (2n=72) of EBN=4, are given in Table 41, while the field materials used for these experiments are shown in Table 42.

With few exceptions, crosses of *S. olmosense* with one of its closest relatives, *S. raquialatum*, succeeded only when *S.olmosense* was used as the staminate parent. Such results might be easily explained by the fact that both species are EBN=1. However, in two other species having EBN=1, *S. ingaefolium* and *S. wittmackii*, seed was not obtained in either direction of the cross.

Again, crosses between *S. bukasovii* (♀) (EBN=2) and *S. olmosense* (♂) were greatly successful when the latter species was used as the staminate parent; this, despite the fact that the two species are very different morphologically, have different EBN values, and occur in quite different ecological habitats. A few dominant features of *S. bukasovii* appear strongly in the F_1 progeny of this cross, including the color of the corolla and the nature of the leaves, but certain other characteristics, such as corolla shape, point of articulation of the pedicel and the shape of the calyx, emerged intermediate in appearance between the two species. However, reciprocal crosses between *S. olmosense* and several other species with EBN=2, such as *S. piurae* and *S. ambosinum*, failed to yield seed in either direction.

Lastly, it should be pointed out that exceptionally large amounts of seed were obtained in crosses made between *S. olmosense* and two tetraploid species of EBN=2, *S. tuquerrense* and *S. colombianum*, but again only when *S. olmosense* was used as the staminate parent. The cross involving *S. tuquerrense*, in particular, yielded the highest total number of seeds per berry for any of the plants used in this study.

Table 41. Fertility of *Solanum olmosense* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	INGAEFOLIA	× *S. ingaefolium*	4(1)	0(0)	0(00)
			× *S. raquialatum*	50(66)	3(8)	0(67)
24	1	PIURANA	× *S. hypacrarthrum*	13	11	30
24	1	TUBEROSA	× *S. chancayense*	87(8)	0(3)	0(15)
			× *S. minutifoliolum*	8(9)	0(4)	0(93)
			× *S. mochiquense*	42(68)	0(10)	0(18)
			× *S. wittmackii*	6(5)	0(0)	0(0)
24	2	CONICIBACCATA	× *S. calacalinum*	6(40)	6(0)	8(0)
			× *S. chilliasense*	2(7)	0(4)	0(75)
			× *S. chomatophilum*	58(6)	10(0)	2(0)
			× *S. rhombilanceolatum*	17(13)	1(1)	0(0)
			× *S. suffrutescens*	8(11)	0(0)	0(0)
24	2	INGAEFOLIA	× *S. jalcae*	171	66	4
24	2	PIURANA	× *S. albornozii*	56(16)	11(10)	6(10)
			× *S. piurae*	15(6)	11(0)	0(0)
24	2	TUBEROSA	× *S. ambosinum*	6	0	0
			× *S. bukasovii*	68(43)	0(16)	0(100)
			× *S. coelestispetalum*	24(25)	1(18)	0(60)
			× *S. orophilum*	51(18)	7(1)	0(17)
48	2	CONICIBACCATA	× *S. colombianum*	27(6)	0(1)	0(100)
			× *S. paucijugum*	21	0	0
			× *S. tuquerrense*	16(4)	0(3)	0(133)
		PIURANA	× *S. solisii*	10(6)	0(0)	0(0)
48	4	TUBEROSA	× *S. paramoense*	8(8)	0(0)	0(0)
72	4	CONICIBACCATA	× *S. tundalomense*	13(13)	0(8)	0(0)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 42. Collections (OCH) used in *Solanum olmosense* fertility studies.

CONICIBACCATA
S. calacalinum 13836
S. chilliasense 13350
S. chomatophilum 13202, 13212, 14496
S. colombianum 10985, 13381, 13384 13404
S. paucijugum 13371, 13399
S. rhombilanceolatum 13111, 14406
S. tundalomense 11003, 13358, 13367 13396
S. suffrutescens 13375

INGAEFOLIA
S. ingaefolium 11614
S. jalcae 13344, 14490, 14782
S. raquialatum 13947, 13950, 13957, 13958, 14823

OLMOSIANA
S. olmosense 13348

PIURANA
S. albornozii 11007
S. hypacrarthrum 11308
S. piurae 13959
S. solisii 10990
S. tuquerrense 13835

TUBEROSA
S. ambosinum 11865
S. bukasovii 13599, 13602, 13670, 13679, 13712, 14332
S. chancayense 11250
S. coelestispetalum 13686
S. minutifoliolum 13390
S. mochiquense 14870
S. orophilum 12072, 12079, 13011
S. paramoense 11159
S. wittmackii 11029, 11886

SERIES PIURANA

PIURANA Hawkes, Ann. Mag. Nat. Hist., Ser. 12, 7:693, 1954.

Plants short, robust and bushy or with medium-sized erect-ascending stems, stoloniferous and tuber–bearing. Leaves imparipinnate, with or without interjected leaflets, these, when present, frequently subcoriaceous; leaflets vernicose, glabrous or sparsely and coarsely pubescent above; the margins occasionally wavy-crenulate to erose, or sometimes revolute. Corolla usually large and showy. Fruits subellipsoid to ovoid, very rarely long-conical.

From the time series Piurana was first proposed in 1954 up through the present time, the author of this work has been concerned with the clarification of its taxonomic limits. On occasion, this has involved the removing and transferring of some species to either the series Conicibaccata or to the series Tuberosa. It is possible that with further detailed laboratory and field work studies, additional realignments of the species of this group will have to be made.

Various species of series Piurana have been reported to have some potential value in plant breeding programs (Bamberg, 1994; Ochoa, 1954, 1955, 1962). Species that show some resistance to the late blight-causing fungus *Phytophthora infestans* are *S. acroglossum*, *S. chiquidenum*, *S. paucissectum* and *S. ariduphilum*. Others are reported to be resistant to *Erwinia carotovora* or black-leg (*S. acroglossum*, *S. piurae* and *S. hypacrarthrum*), PLRV or leaf roll virus (*S. chiquidenum*, *S. piurae* and *S. acroglossum*) and *Verticillium* wilts (*S. piurae*, *S. acroglossum* and *S. paucissectum*). Moreover, both *S. acroglossum* and *S. paucissectum* have been reported to be resistant to aphids, the Colorado potato beetle (*Leptinotarsa decemlineata*) (Bamberg, 1994) and early frost.

Distribution

The majority of the species of this series (including the new ones treated in this text) are endemic to Peru. However, several occur in Ecuador (*S. chilliasense*, *S. cyanophyllum* and *S. solisii*), and one is known from southern Colombia (*S. tuquerrense*).

KEY TO SERIES PIURANA

1. Stem cylindrical, without wings.
    2. Leaves pilose, slightly vernicose to vernicose.
        3. Leaves little divided, occasionally simple, without interjected leaflets.
            4. Leaflets coriaceous, coarsely hispid.
                5. Corolla white .... 36. *S. chiquidenum*
                5. Corolla purple .... 34. *S. ariduphilum*
            4. Leaflets subcoriaceous, finely pilose .... 39. *S. paucissectum*
        3. Leaves much divided, none simple, with interjected leaflets. .... 37. *S. humectophilum*
    2. Leaves glabrous, vernicose.
        6. Leaves with (0-)1-2 pairs of lateral leaflets and without interjected leaflets .... 33. *S. acroglossum*
        6. Leaves with 2-3(-4) pairs of lateral leaflets and with interjected leaflets.
            7. Corolla all-white with cucullate acumens; calyx lobes apiculate .... 35. *S. cantense*
            7. Corolla white with violet-colored cucullate acumens; calyx lobes long and filiform..................................... 41. *S. yamobambense*
1. Stem subcylindrical, broadly winged.
    8. Leaves with (0-)1-2(-3) pairs of lateral leaflets; terminal leaflet conspicuously much larger than the laterals, the apex cuspidate; corolla white, large, 4-5 cm in dia................................. 38. *S. hypacrarthrum*
    8. Leaves with 2-3(-4) pairs of lateral leaflets; terminal leaflet slightly larger than the laterals, the apex narrowly attenuate and pointed; corolla blue or bluish-violet, small, 2.5-3.0 cm in dia.... 40. *S. piurae*

33. ***Solanum acroglossum*** Juz., Bull. Acad. Sci. USSR, Ser. Biol. 2:313-314, 1937. Figs. 165-168; Map 15.

Plant erect, (15-)25-40(-70) cm tall, glabrous or glabrescent (never rosette-forming at base). Stem usually simple, slightly pigmented or light green, cylindrical, slender, 2-5 mm in dia., wingless, somewhat woody, slightly angular or straight from node to node; stolons very fine or slender, 30 cm or more long; tubers round to ovoid, small, 1-2(-3) cm in dia., white, often one or more along the length of the stolon and either solitary or moniliform. Leaves (2.0-)4.0-9.5(-11.5) cm long by (1.0-1.5-)3.4-7.6 cm broad, simple at base or little divided, with 0-1 (-2) pairs of lateral leaflets and lacking interjected leaflets; petioles (1.0-)2.5-3.5(-4.0) cm long; leaflets dark green, vernicose, generally glabrous or occasionally very sparsely and shortly pilose above and light green or purplish with short bristly hairs along the veins below; margins more or less revolute, somewhat denticulate and shortly ciliate; terminal leaflet longer and broader than the laterals, (3.5-)4.0-6.0(-7.5) cm long by (1.3-)2.0-2.5(-3.5) cm broad, elliptic-lanceolate or broadly oblong-lanceolate to obovate-lanceolate, the apex obtuse (always so in basal leaves) or gradually grading toward acuminate, and the base narrowed or cuneate; lateral leaflets lanceolate or narrowly elliptic-lanceolate, (1-)3-4(-5) cm long by 0.6-1.3 cm broad, obtusely-tipped with tongue-shaped acumens and often, but not always, basiscopically narrowly-decurrent about the rachis; basal pair of leaflets when present very reduced in size. Pseudostipular leaves narrowly falcate or clasping, 7-12 mm long by 4-6 mm broad. Inflorescence cymose, 1-5(-10)-flowered. Peduncle 2-5 cm long, slender, 1 mm in dia., glabrous, pigmented like the pedicels and calyx; pedicels 10-25 mm long, articulated 4-7 mm below the calyx. Calyx fleshy, 5-6(-7.5) mm long; lobes narrowly ovate-lanceolate to subquadrate, acuminate; acumens linear or narrowly subspatulate, 1.5-2.0 (-2.5) mm long. Corolla broadly rotate to rotate pentagonal, 3.0-3.5(-4.0) cm in dia. (Fig. 166), light blue with darker blue along the edges of the internal star or occasionally light bluish-purple (never white); with well-defined semi-rounded lobes and short, pointed acumens with densely pubescent tips and external surfaces. Anthers 6.5-7.5 mm long, narrowly lanceolate, with well defined dorsal grooves and cordate bases; filaments 1-2 mm long, glabrous. Style 10-11 mm long, filiform, papillose below the midpoint; stigma small, capitate, cleft. Fruit usually globose, rarely broadly ovoid, 1.5-1.8 cm in dia., green with 1-2 vertical dark-violet streaks (Fig. 167). Chromosome Number: 2n=24. EBN=2.

Local Names: *Papa de Amaa* (or "Potato of the Ancients," at Panao, Huánuco) and *Auqui Papa* ("Potato of the Forefathers," at Tusi, Pasco).

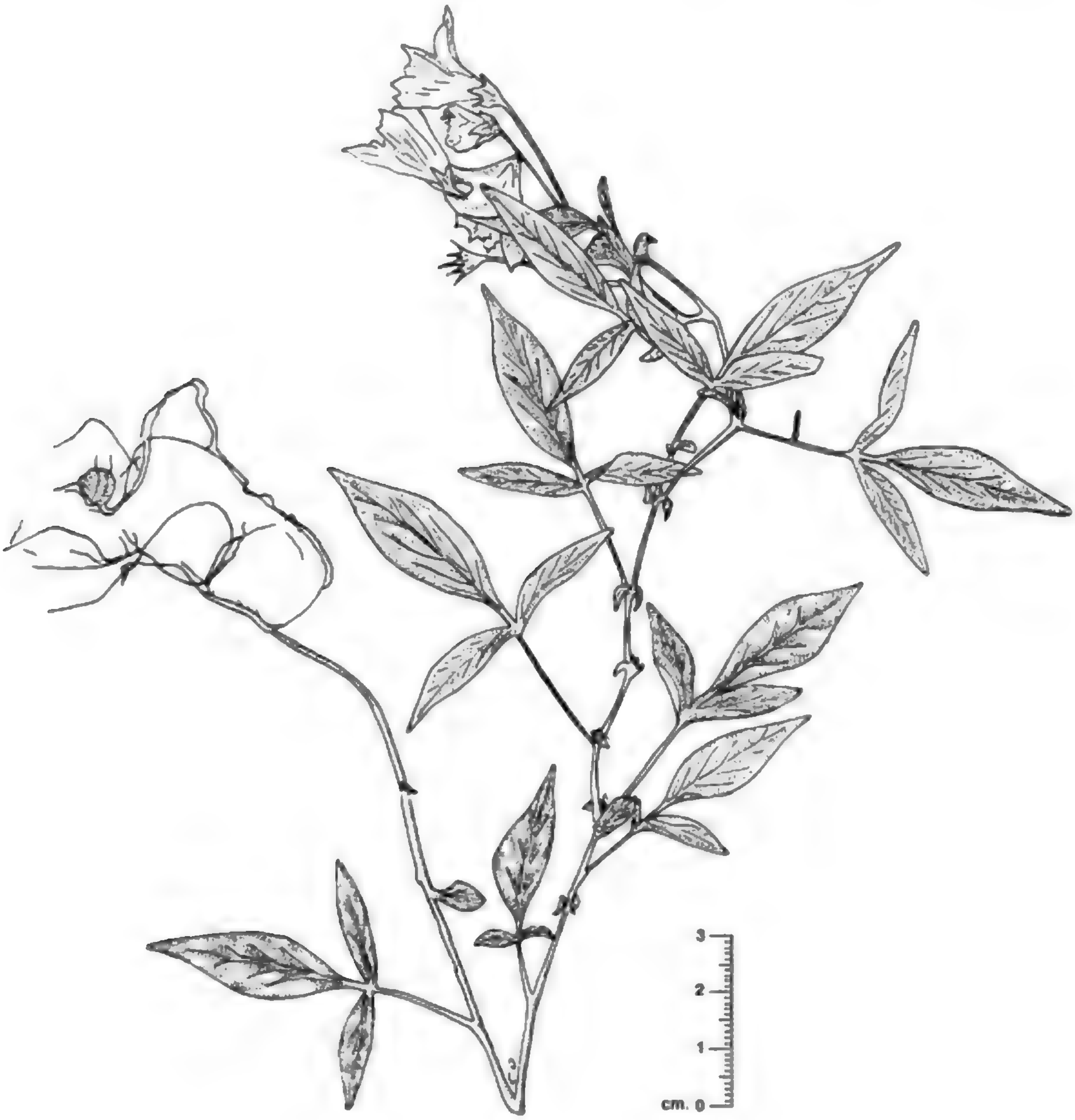


Figure 165. *Solanum acroglossum* (*Juz. 10672*, type).

Type: PERU. Department Junín [today Department Pasco], near the City of Cerro de Pasco, between Cajamarca [Cajamarquilla] and Huariaca, 12 March 1927, *S. Juzepczuk 10672* (LE, OCH).

Affinities

Much additional knowledge with regard to the relationships of the various species of this series has been gained as a result of the renewed efforts of our CIP team to explore the north and northeast regions of Peru, particularly in the vicinity of the type locality of *S. piurae*. These activities have not only led to the enrichment of our general herbarium collections, but also, in reality, to the publication of several new species. One concrete result of all of this work has been the realization by the author that *S. acroglossum* is more closely related to *S. chiquidenum* than to any other species. The two are alike, for example, in producing moniliform tubers and in having similarly-formed coriaceous leaves that bear sessile, ciliate-margined leaflets. Moreover, both species show considerable resistance to the late-blight causing organism, *Phytophthora infestans*. These two species, therefore, might be regarded as potentially good candidates for inclusion in breeding programs aimed at the genetic improvement of the common potato.

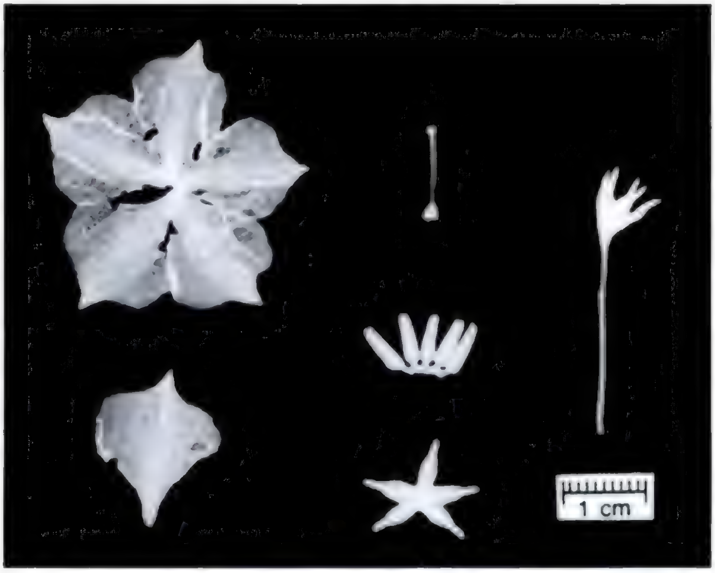


Figure 166. Floral dissection of *Solanum acroglossum* (*Ochoa 11297*).

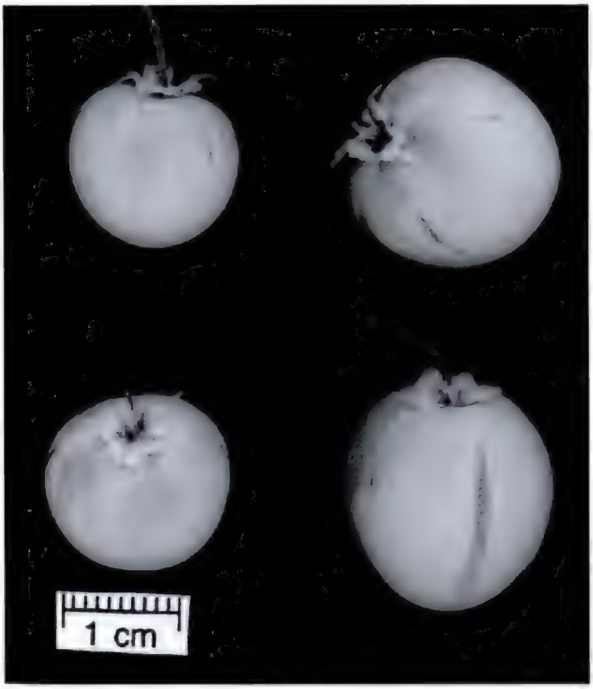


Figure 167. Fruits of *Solanum acroglossum* (*Ochoa 11297*).

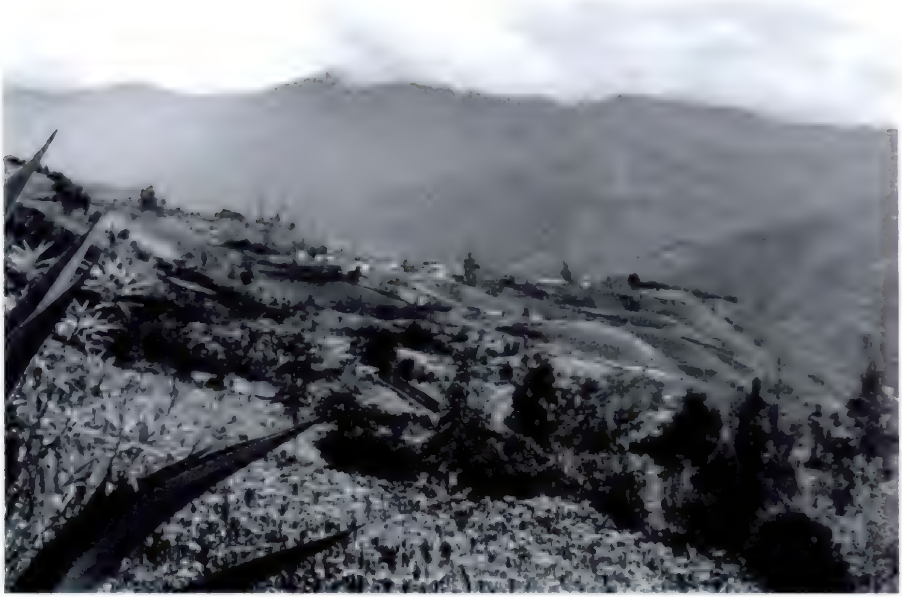


Figure 168. Habitat of *Solanum acroglossum*, Panao, Huanuco, 1970.

Habitat and Distribution

Solanum acroglossum grows preferentially in the temperate to cool-temperate zones of both the Ceja de Montaña and the quebradas of the interandean region, generally at altitudes between 2500 and 3000 m (see Fig. 168). However, it has also been occasionally collected in the still cooler Andean *puna* zone, where it grows at altitudes between 3500 and 3700 m. At the lower altitudinal levels of it range, this species commonly occurs in small stands of shrub forest, often in fairly moist soils. Here, it may be associated with shrubs of the genus *Rubus*, *Calceolaria*, *Fuchsia*, *Monnina* and *Solanum*, herbs of the genus *Alisma*, *Commelina* and *Poa*, and various species of ferns and composites. In total, the geographical range of this species extends from the Department of Huánuco (9°23' S and 76°43' W) to the Department of Pasco (10°28' S and 76°21' W), Map 15.

Specimens Examined

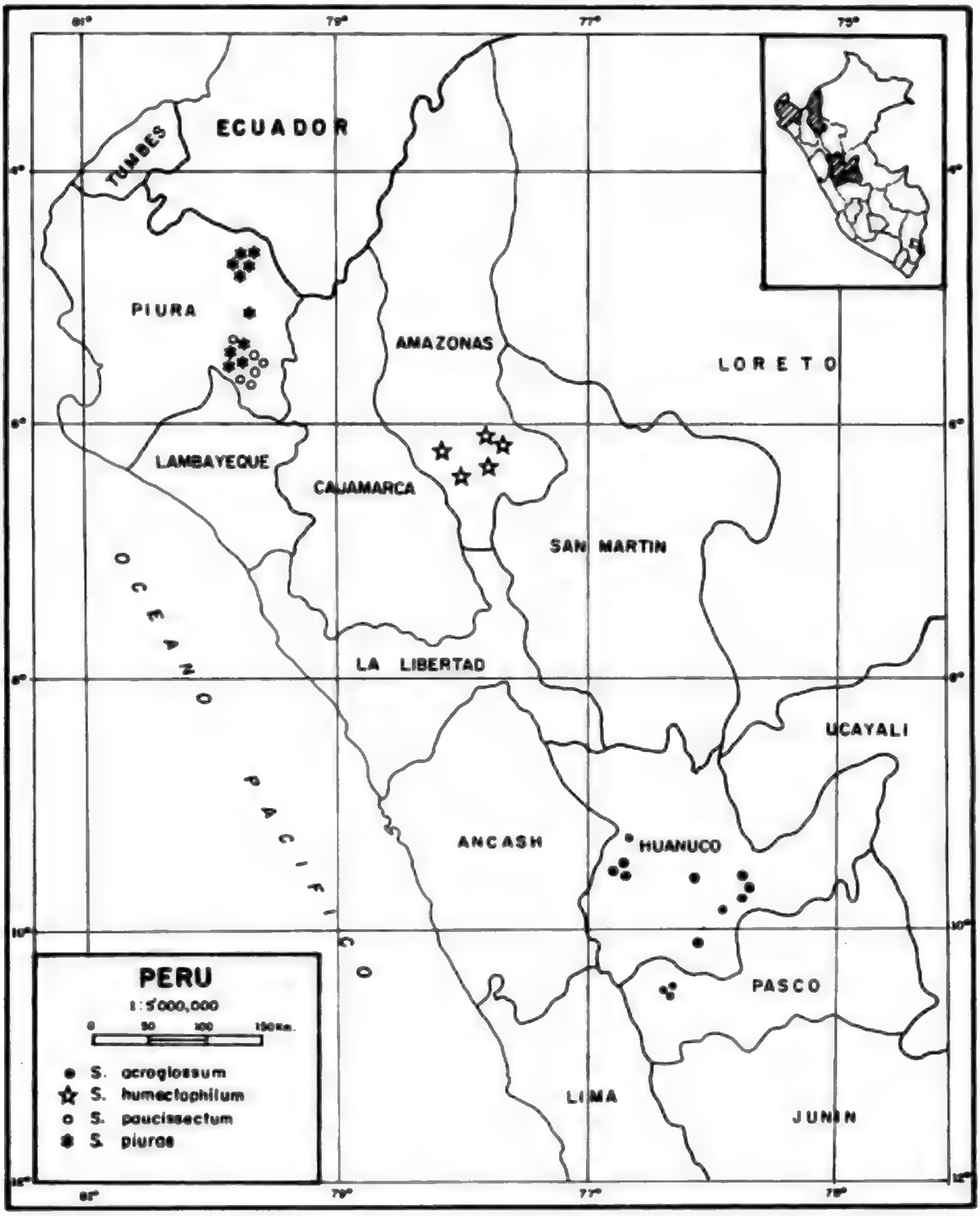
Department Huánuco

Province Dos de Mayo: Cerro Intipunco, 3100 m alt., northwest of Nuevas Flores, corolla blue-violet, 21 April 1961, *C. Ochoa 2353*, 2n=24 (OCH). Marca, 2800 m alt., north of Quivilla, on the Nuevas Flores-Llata road, on stony land, flowers violet, April 1961, *C. Ochoa 2355* (OCH).

Province Huamalíes: Lower slopes of Cerro Llacuy, facing Llata, 3310 m alt., flowers blue-violet, 23 April 1961, *C. Ochoa 2354* (OCH). Sausián, 3200 m alt, near the right bank of the Carpa River on the Tantamayo-Urpish road, in black soils, among grasses, very scarce, flowers blue-violet, April 1961, *C. Ochoa 2365* (OCH).

Province Huánuco: Pillao, 2700 m alt., flowers large, light-purple, scarce, 13 February 1946, *F. Woytkowski 34032* (F, UC). Llaulli (Tambogán), 3800 m alt., near Pezer on the road to Inca Cocha, in rock caves among large boulders, associated with a grass (= *Stipa*), scarce, 8 April 1976, *C. Ochoa 11053* (OCH, UNTC). Llaulli, 3800 m alt., near Pezer on the road to Inca Cocha, scarce, 8 April 1976, *C. Ochoa 11054* (OCH). Quebrada de Huallanca Ragra (Tambogán), 3090 m alt., along the edges of irrigation ditches, very scarce, 8 April 1976, *C. Ochoa 11056* (OCH).

Province Pachitea: Panao, subtropical rainforest, herb with purple flowers, 3 March 1947, *R. Ferreyra 1768* (USM). High slopes of Wircagagay, 3000 m alt., between km 46 and 48 on the Huánuco-Panao road, flowers blue, tubers round or elongated, white, small, 1-2 cm long, moniliform, 19 March 1951, *C. Ochoa 1102*, *1103* and *1104*, all three with 2n=24 (OCH). Near Wircagagay, on the



Map 15. Distribution of *Solanum acroglossum, S. humectophilum, S. paucissectum* and *S. piurae*.

Huánuco-Panao road, 2900 m alt., April 1961, *C. Ochoa S66*, 2n=24 (= *PI-498204*, from living plants examined in the collection of the Potato Introduction Station, Sturgeon Bay, Wis., USA). Lower slopes of Wircagagay, 2025 m alt., on the Huánuco-Panao road, following the Tambillo detour, leaves coarsely pilose, flowers blue-violet, large, 1 May 1967, *C. Ochoa 2652* (OCH).

Department Pasco

Province Daniel A. Carrión: Near Pucará, 3700 m alt., between Pampania and Jacha, District Tusi, flowers blue-violet, leaves sparsely pilose above, 3 May 1963, *C. Ochoa 2470*, 2n=24 (OCH). Shocec, 2800 m alt., near Antapirca, flowers deep blue-violet, growing among reeds (*Arundo* sp.) along with another tuberous species, *Solanum ambosinum* (*OCH 11865*). Originally collected 28 January 1978; tubers only, mixed with *S. ambosinum*. Because only tuber samples were collected in nature, herbarium specímen *11865A* was made from plants grown in the greenhouse at CIP-Huancayo, 2n=24 (OCH).

Province Pasco: Between Cajamarca [Cajamarquilla] and Huariaca, near Cerro de Pasco, flowers dark blue-violet, 8 March 1917, *S. Juzepczuk 10672* (LE, OCH, type collection). Tingo, 2900 m alt., 1 km before Paucartambo, on the Carhuamayo-Paucartambo road, among shrubs of *Berberis* and tufts of *Stipa*, scarce, flowers blue-violet, 22 March 1968, *C. Ochoa 2680*, 2n=24 (OCH). Between Tuchuaín and Llamapasillum, 3500 m alt., about 10 km from Pampania, flowers blue-violet, 5 March 1977, *C. Ochoa 11297*, 2n=24 (OCH) and (CIP, NY, MOL, from specimens collected in the experimental fields at Huancayo).

Table 43. Fertility of *Solanum acroglossum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	2	CONICIBACCATA	× *S. chomatophilum*	13	8	18
		PIURANA	× *S. chiquidenum*	20(4)	5(2)	27(0)
		TUBEROSA	× *S. ambosinum*	5(12)	4(0)	175(0)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

Two field collections of *S. acroglossum* (*OCH 11297 and 11865A*) were experimentally crossed with collections of *S. ambosinum* (*OCH 13852*), *S. chiquidenum* (*OCH 13965A and 15230*) and *S. chomatophilum* (*OCH 11755 and 13010*).

Of the various unilateral and reciprocal combinations that were attempted (see Table 43), only the unilateral cross of *S. acroglossum* with *S. ambosinum* yielded a high average number of seeds per berry. When *S. ambosinum* was used as the pistillate parent, neither fruits nor seed were obtained.

Although *S. acroglossum* is morphologically similar in some respects to *S. chiquidenum*, crosses between these two species yielded only a very low average number of seeds (27) per berry, and only when *S. chiquidenum* was used as the staminate parent.

In the unilateral cross involving *S. chomatophilum*, although proving successful, only a low average number of seeds per berry (18) was obtained.

34. *Solanum ariduphilum* Ochoa, Bol. Soc. Argentina Bot. 14(4):230-234, 1972.

Figs. 169-170; Map 16.

Plant erect to erect-decumbent, rarely rosette forming at base, small, (15-)25-40 (-60) cm tall. Stem simple, flexed, slender and glabrescent, 2.5-5.0 mm in dia., wingless, light green or slightly pigmented toward the base and in the leaf axils; internodes short, (1-)2-3(-5) cm long. Plant stoloniferous and tuber-bearing, stolons 50-80 cm long, fleshy and thick, ca. 4 mm in dia., simple or branched; tubers round to ovoid, occasionally long-subcylindrical or subfalcate, white, small, 1.0-2.5(-4.0) cm long, often one or more along the length of the stolon and either solitary or moniliform; tuber buds finely pilose, becoming densely covered at maturity with white, 2-3 mm-long hairs. Leaves imparipinnate or occasionally simple, 7-13 cm long by 3.5-9.5 cm broad, little divided, with (0-)1-2 pairs of leaflets and 0-1 pairs of interjected leaflets or rarely with 3 pairs of leaflets and 2 pairs of interjected leaflets, on petioles (1-)2-3 cm long; leaflets coriaceous, thick and rough, somewhat shiny and glabrous or glabrescent above, very sparsely pubescent below, with fimbriate or occasionally wavy-subcrenulate margins. Terminal leaflet ovate-lanceolate to elliptic-lanceolate, usually much larger than the laterals, 5.0-7.5 cm long by 2.0-3.5 cm broad, the apex slightly to sharply to pointed and the base broadly rounded; lateral leaflets narrowly elliptic-lanceolate or lanceolate, sessile to basiscopically obliquely decurrent in the first pair and sessile or subsessile in the much smaller second pair when present. Pseudostipular leaves narrowly falcate, small, 4-8(-12) mm long by 2-3(-5) mm broad. Inflorescence cymose, 3-6(-10)-flowered. Peduncle short, 2-5 cm long,

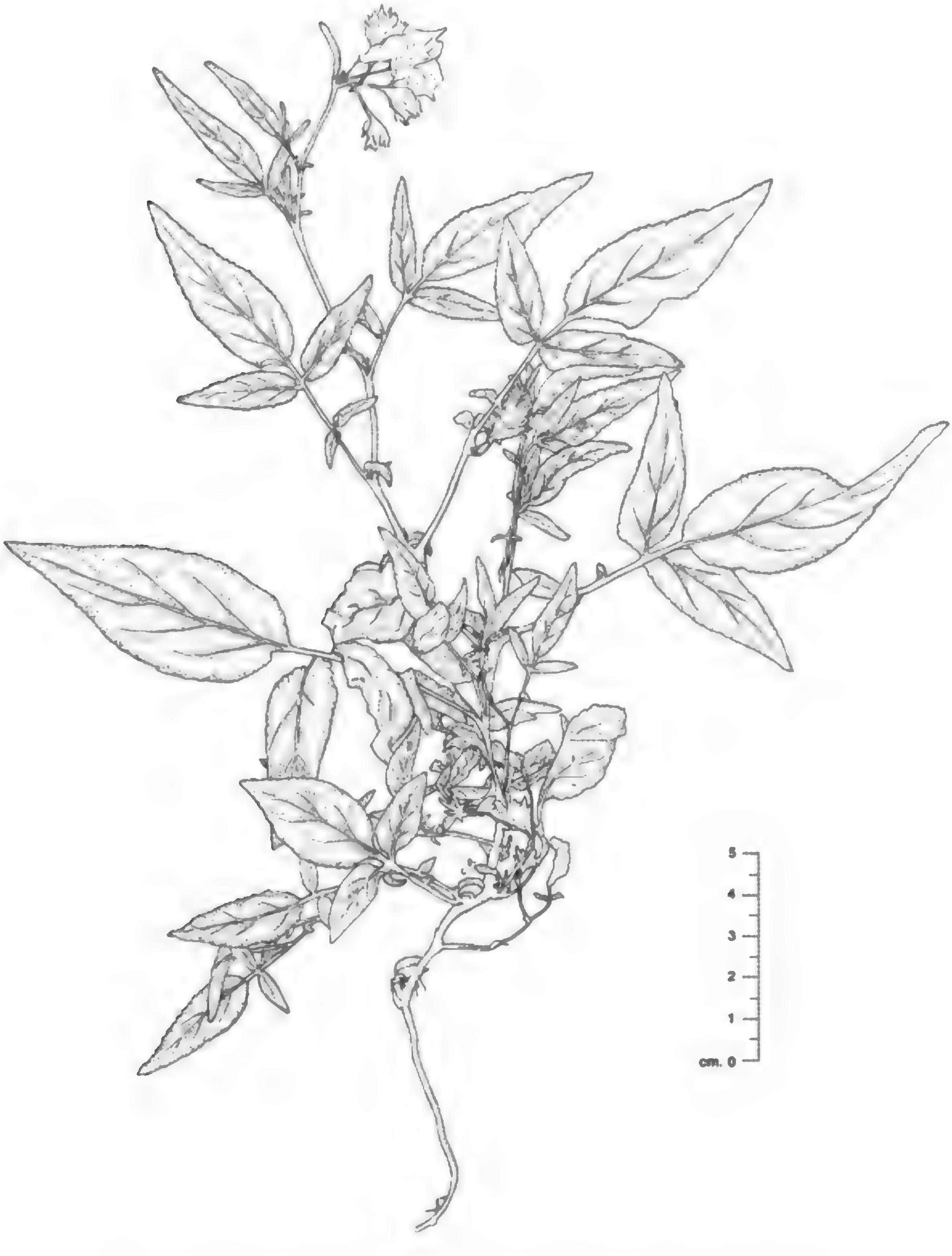


Figure 169. *Solanum ariduphilum* (*Ochoa 2637*, holotype).

very sparsely pubescent like the pedicels and calyx; pedicels short, 15-20(-25) mm long, slender, 1.5-2.0 mm in dia. at base and articulated about 7 mm below the calyx. Calyx generally symmetrical, campanulate, 7-8 mm long; lobes strigose, unequally long, narrowly elliptic-lanceolate and abruptly acuminate at apex; acumens pointed or subspatulate, 2-3 mm long. Corolla rotate, 2.5-3.0 cm in dia., purple, with densely pubescent acumen margins (Fig. 170). Anthers narrowly lanceolate, 5.5-6.0 mm long, pale yellow; filaments short, less than 1 mm long, white-hyaline, pubescent only on the inside of the staminal tube. Style 10 mm long, exerted 2 mm, glabrous or slightly papillose below the midpoint; stigma capitate, very small, only very slightly enlarged at the apex of the style. Fruit subellipsoid to ovoid, light green, marked with vertical streaks but not flected with white spots, 1.5-2.0 cm long. Chromosome Number: 2n=24. EBN=2.

Local name: *Amaa Papa* ("Potato of the Ancients").

Type: PERU. Department Huánuco, Province Huamalies, Jamanca or Samanga, 3340 m alt., between Llata and Chavín de Pariarca, 24 April 1967, *C. Ochoa 2637* (holotype OCH, isotypes MOL, UNTC, USM).

Affinities

Through its characteristic leaf shape and dissection, coriaceous leaflets, fruit shape and winged cylindrical stem, *S. ariduphilum* shares more features in common with *S. chiquidenum* than with *S. piurae*, which is recognized as the type species

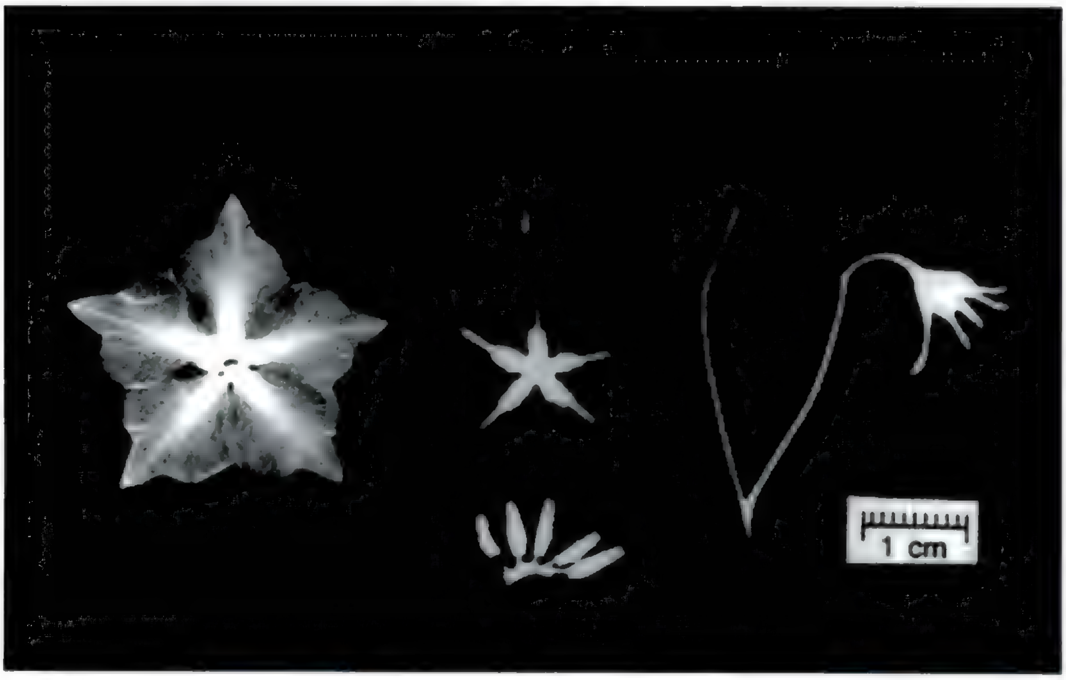


Figure 170. Floral dissection of *Solanum ariduphilum* (*Ochoa 2637*, holotype).

of this series. However, *S. aridubhilum* differs from *S. chiquidenum* in several important ways, including the color of its fruits and corolla, the pubescence of its filaments and in life form.

Habitat and Distribution

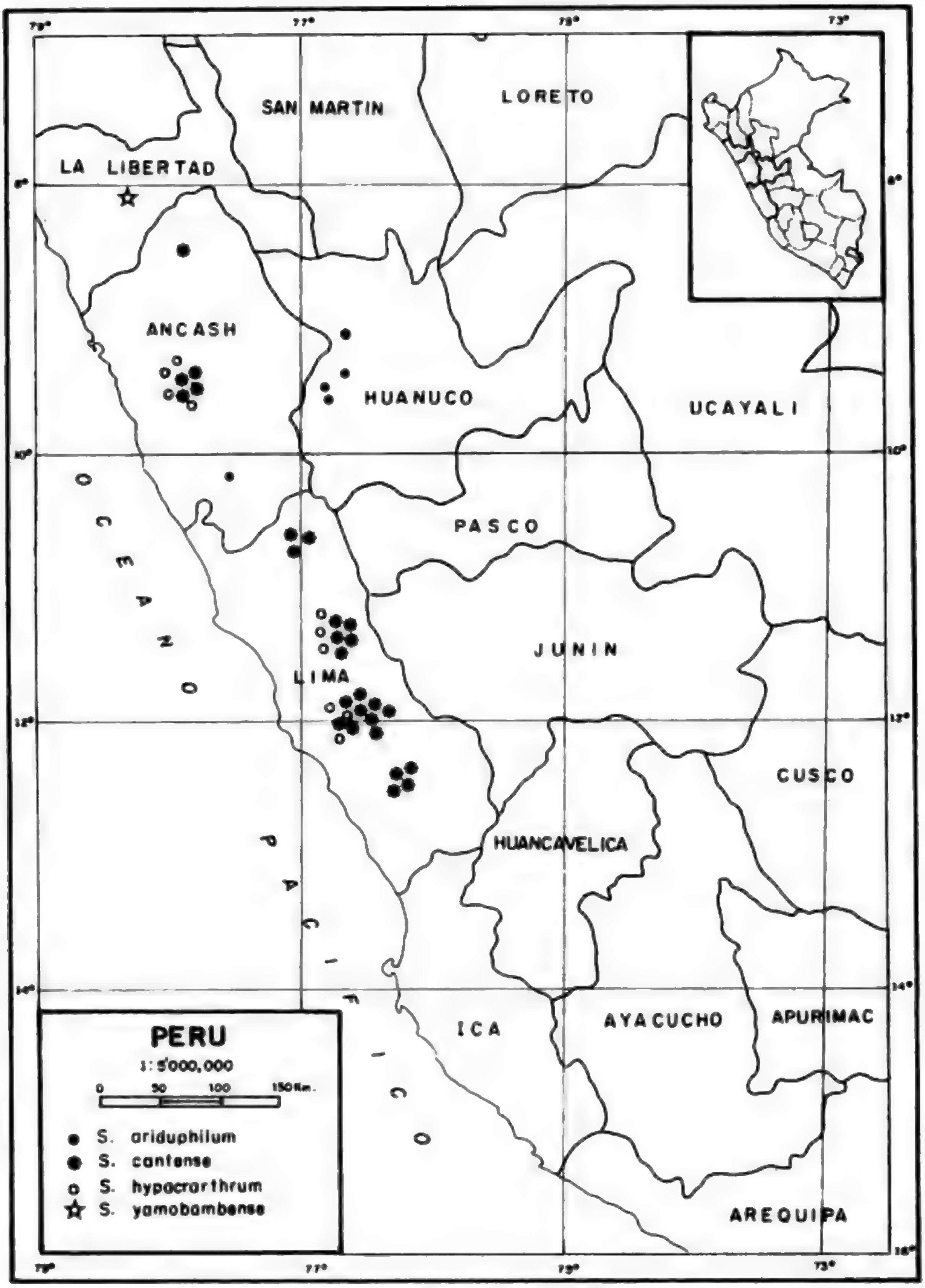
This plant, which loves to grow in dry or subxerophytic habitats, is appropriately named "ariduphilum" (from the Latin *aridus* meaning dry and *philum* meaning loving dry places). It grows commonly on very steep rocky slopes or in the poor soils of semiarid valleys at altitudes between 3200 and 3400 m, where it is associated with columnar cactus and bromeliads, shrubs such as *Agave* and *Cortaderia*, and herbaceous plants of the genus *Salvia* and *Bidens*. It also occurs with certain species of *Stipa* in much higher and cooler places, such as in the jalcas and quebradas of Pujín (3700 m alt.) near Tantamayo in northern Peru.

Currently, *S. ariduphilum* is known only from the Province of Huamalies, Department of Huánuco, Peru (Map 16).

Specimens Examined

Department Huánuco

Province Huamalíes: Jamanca or Samanga, 3340 m alt., between Llata and Chavín de Pariarca, 24 April 1967, C. *Ochoa 2637*, 2n=24 (MOL, OCH, UNTC, USM, type collection of *S. ariduphilum*). Near Jamanca, 3340 m alt., going down from Lingay to Chuiquibamba, 24 April 1967, C. *Ochoa 2638* (OCH). Between Pujín and Tantamayo, 3720 m alt., on rocky slopes, in *jalca*, associated with *Stipa* sp., plants 20-30 cm tall, stems pilose, flowers dark violet, 25 April 1967, C. *Ochoa 2639*, 2n=24 (OCH). Ruins of Uchcupuño, 3480 m alt., in crevices of the stone walls of ruins situated between the punas of Condorchaca and Sausián; plants small, 15-25 cm tall, somewhat rosette forming at the base; leaves pubescent and coriaceous; flowers dark violet, 26 April 1967, C. *Ochoa 2645* (MOL, OCH).



Map 16. Distribution of *Solanum ariduphilum, S. cantense, S. hypacrarthrum* and *S. yamobambense*.

Table 44. Fertility of *Solanum ariduphilum.* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	2	CONICIBACCATA	× *S. chomatophilum*	19(16)	14(5)	0(37)
24	2	CUNEOALATA	× *S.* × *blanco-galdosii*	5	3	40
24	2	PIURANA	× *S. piurae*	17(62)	10(40)	0(50)
24	2	TUBEROSA	× *S. ambosinum*	4(20)	1(18)	0(20)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

Reciprocal crosses of *S. ariduphilum* (*OCH 2637*) with *S. piurae* (*OCH13959*), *S. chomatophilum* (*OCH 13106, 13196, 13200*) and *S. ambosinum* (*OCH 11865, 13853*) were successful only when these three other wild diploid species were used as the pistillate parent (see Table 44). Even so, the average number of seeds formed per berry was relatively modest. Similarly, while little trouble was experienced in crossing *S. ariduphilum* with *S.* × *blanco-galdosii* (*OCH 13009*), the yields were relatively low.

35. *Solanum cantense* Ochoa, Agronomía (Lima) 26(3):217-218, illustr., 1959.

Figs. 171-174; Map 16; Plate XVI.

Plant rigidly erect, 30-50(-70) cm tall. Stem slightly woody, simple, 3-5(-8) mm in dia. at base, cylindrical, pigmented dark brown in the lower one-third of its length, glabrous or occasionally sparsely pubescent with silvery-white, 2-3 mm-long multicellular hairs; internodes 1.5-4.5(-6.0) cm long; stolons 25-40 cm long; tubers small, 1.5-2.0(-3.5) cm long, white, round to ovoid, forming singly or like beads on a string (moniliform; see Fig. 173). Leaves light green, thick, imparipinnate or simple at base, (5.0-)8.0-11.5(-16.0) cm long by (4.0-)6.0-8.5 (-11.0) cm broad, usually little divided, 2-3(-4) pairs of leaflets and 0-2(-3) pairs of interjected leaflets; petioles short, 6-8(-12) mm long; rachis very sparsely long-pilose, especially on the lower leaf surface. Leaflets coriaceous, glabrous and conspicuously vernicose (sparsely pilose only on the veins of the lower leaf sur-

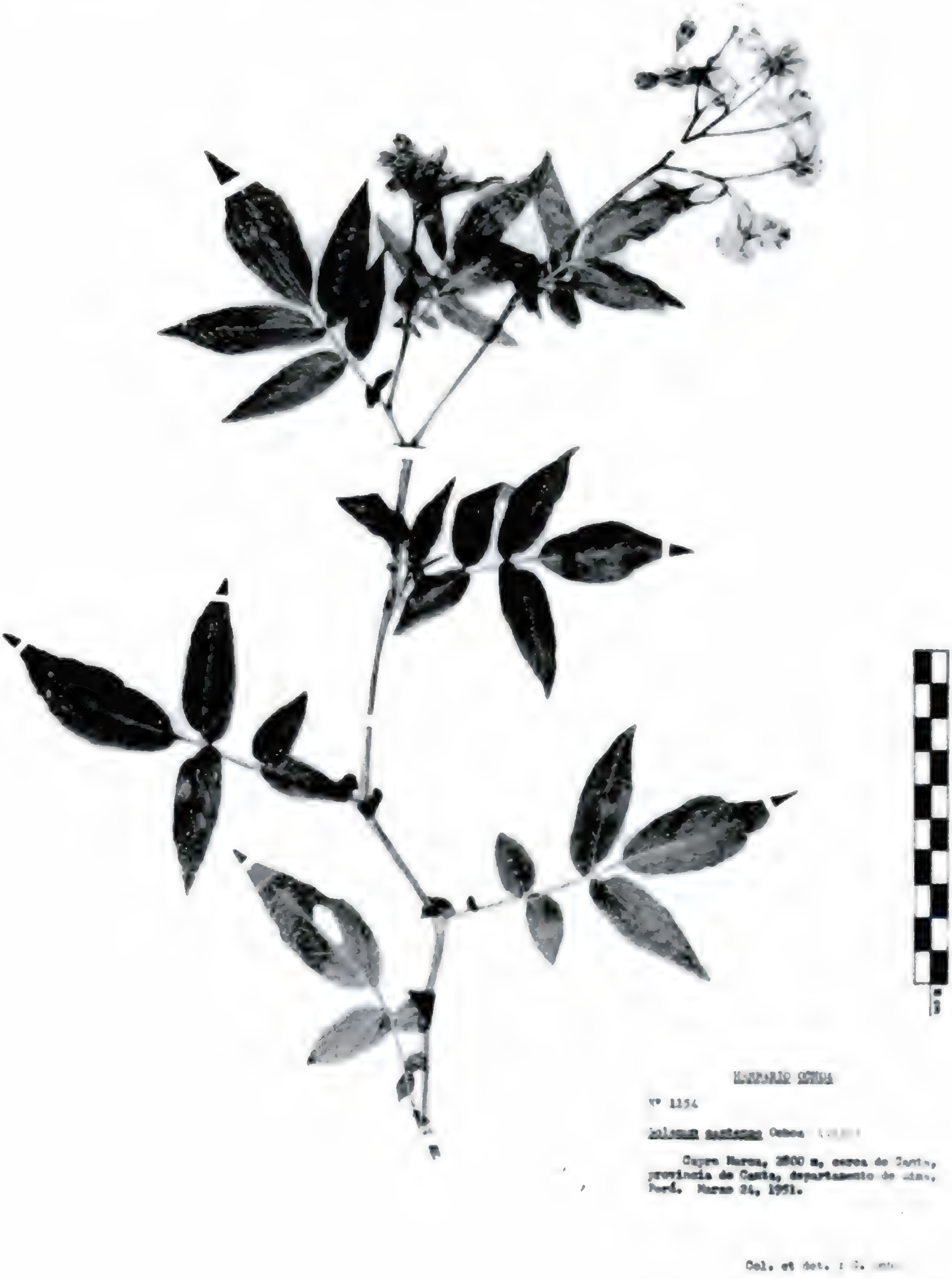


Figure 171. *Solanum cantense* (*Ochoa 1154*, holotype).

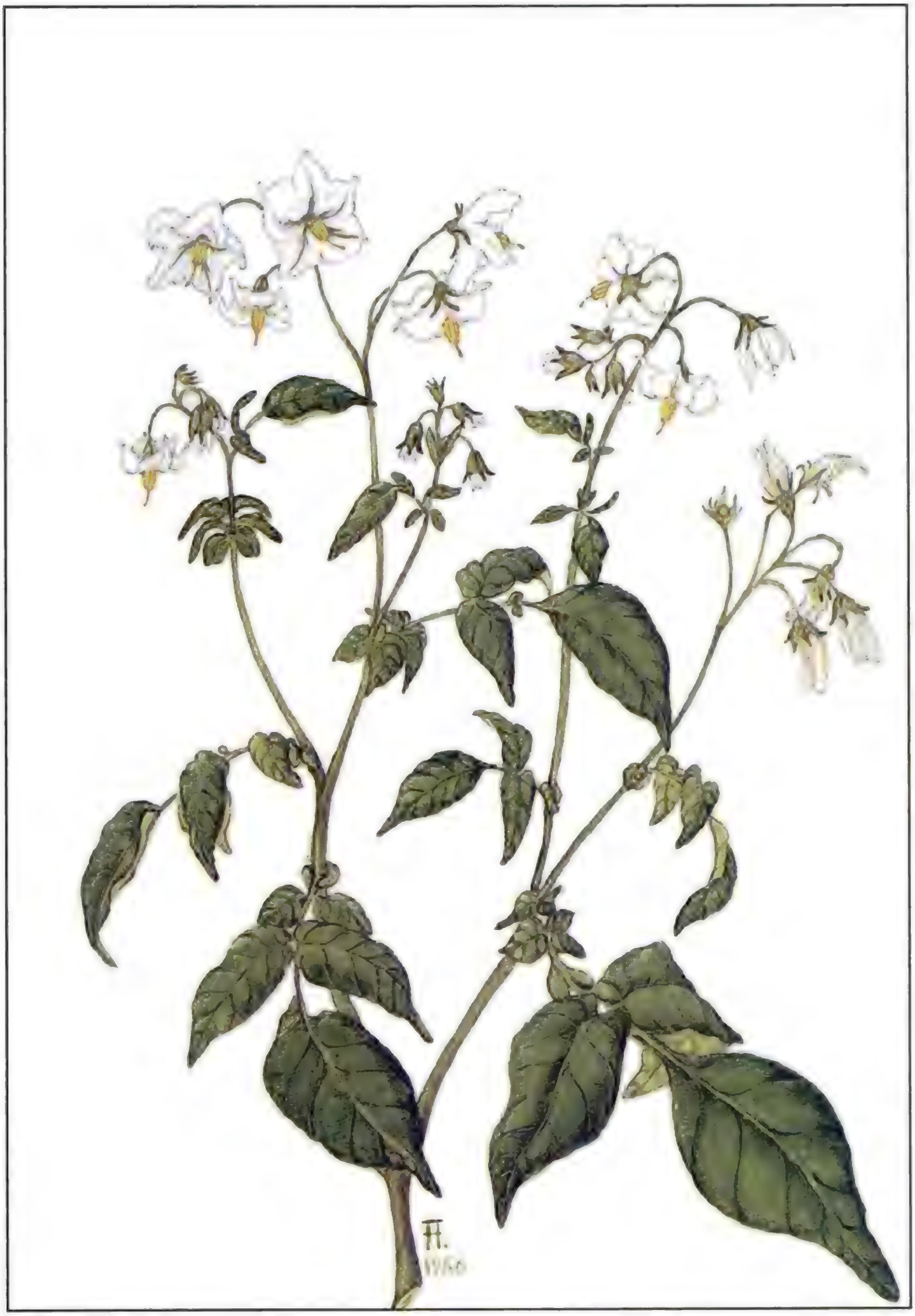


Plate XVI. *Solanum cantense* Ochoa.

face), margins hispid and somewhat revolute. Terminal leaflet elliptic-lanceolate or broadly ovate-lanceolate, somewhat larger and broader than the first pair of lateral leaflets, (3-)5-7 cm long by (1.5-)2.4-3.2 cm broad, the apex pointed or acuminate and the base rounded, on 5-10 mm-long petiolules (these lacking interjected leaflets). Lateral leaflets (2.0-)3.5-5.3 cm long by (0.8-)1.2-2.0 cm broad, narrowly elliptic-lanceolate or lanceolate, the apex pointed or acuminate and the base symmetrically rounded to slightly oblique, occasionally narrowly decurrent about the rachis or essentially sessile, rarely shortly petiolulate. Pseudostipular leaves semiovate to lunate, 9-10(-14) mm long by 4-6(-9) mm broad. Inflorescences terminal and pseudoterminal, cymose, frequently 15-25-flowered. Peduncle 5.5-8.5 cm long, slender, 1.5-2.0 mm in dia. at base; pedicels 1.5-2.5(-3.5) cm long, articulated 6-8(-12) mm below the base of the calyx. Calyx membranous, light green, glabrous or subglabrous, 6-8(-9) mm long, narrowed gradually toward the base, rarely subcampanulate; lobes narrowly ovate-lanceolate, attenuate or narrowed apically to the 1.5-2.5 mm-long acumens. Corolla white with a yellowish internal star, rotate, 2.5-3.0(-3.5) cm in dia.; lobes, including the acumen, 4.5-5.5 mm long; acumens cucullate with pubescent margins (Fig. 172), 3.5-4.0 mm long, rarely externally colored pale-rose. Anthers lanceolate, 5.5-6.5 mm long, yellowish-orange, the base distinctly cordate; filaments 1.5-2.0 mm long, glabrous. Style 10-12 mm long, very slender, densely papillose in the basal two-thirds of its length; stigma capitate, small, slightly enlarged at apex. Fruit round to ovoid, 1.8-2.2 cm long, light green with dark green vertical striping Fig. 174). Chromosome Number: 2n=24. EBN=2.

Local names: *Papa de Gentil* or *Papa de Abuelo* at Acochaca and Lachaqui, prov. Canta, Lima.

Type: PERU. Department Lima, Province Canta, Capra Marca, 2800 m alt., near Canta, 24 March 1951, *C. Ochoa 1154*, 2n=24 (holotype, OCH, isotype LE).

As is not unusual in the course of preparation of a taxonomic monograph, a number of herbarium sheets were renamed during the course of the current work. All collections from the Department of Lima, Peru that were formerly treated by Correll (1962) as belonging to the species *S. piurae*, for example, were reclassified in the present work under the species *S. cantense*. However, it should be pointed out that both the original description of *S. cantense* (*cf.* Ochoa 1959) and the one made by Correll (1962) were based upon a single collection of *S. cantense* (*Ochoa-1154*), and therefore the true extent of variation of this species in nature could not have been well known at the time. Subsequently, many more collec-

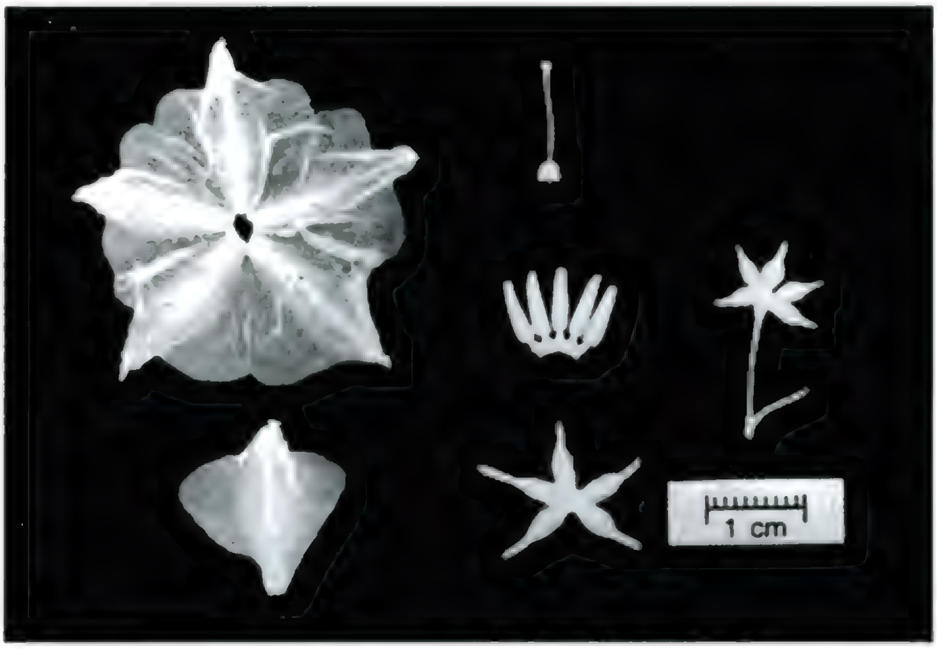


Figure 172. Floral dissection of *Solanum cantense* (*Ochoa 14692*).

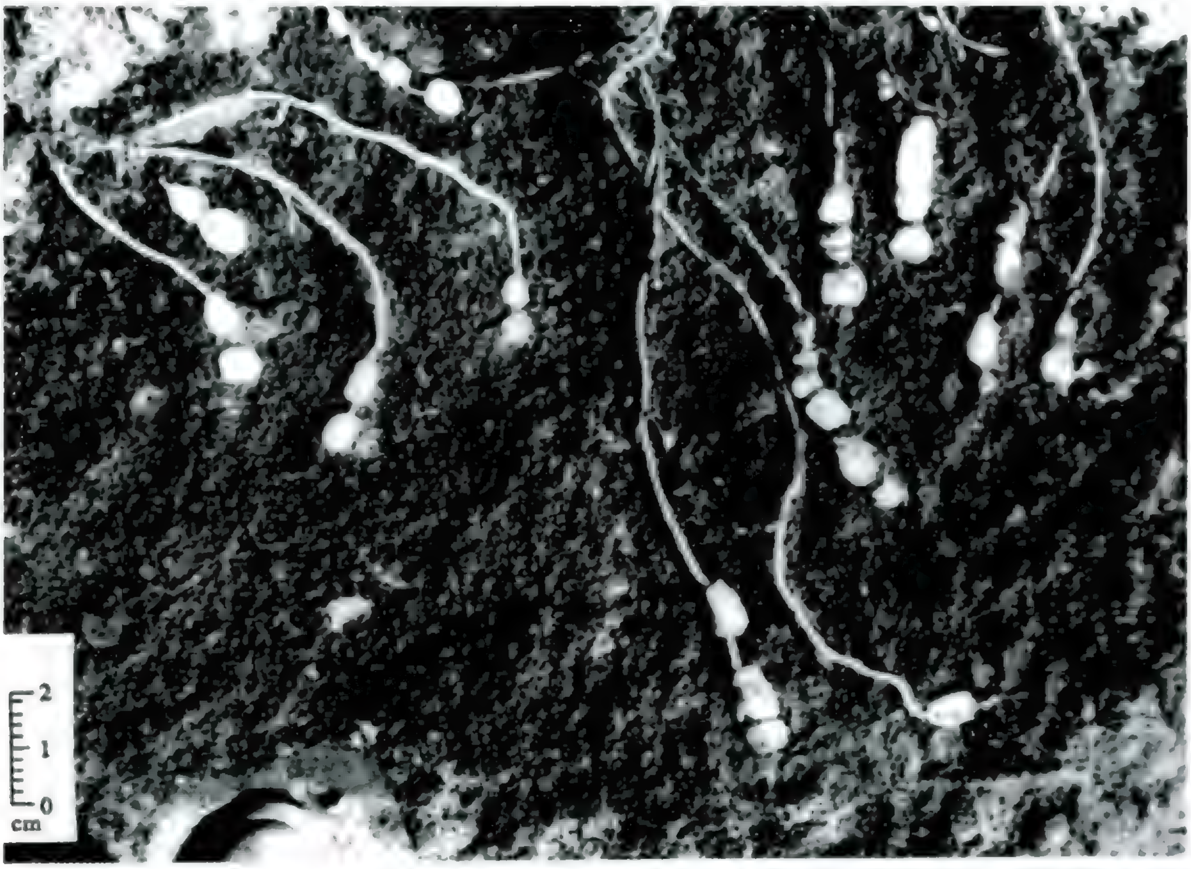


Figure 173. Stolons and tubers of *Solanum cantense* (*Ochoa 1154*).

tions of *S. cantense* have been added to the world's herbaria, and this has had the effect of considerably amplifying our knowledge of the range of this species and its diversity.

Unfortunately, as it turns out, the particular plant specimen chosen by Correll (1962) to illustrate *S. piurae* (*MacBride 2954*) is not of that species but *S. cantense*. The illustrated specimen closely resembles a variant of *S. cantense* with pure white flowers that was collected by the author (*Ochoa 2958*) at the Cuesta de Huamantanga, near Lima.

In the Gray Herbarium at Harvard University, there exists a specimen of a wild potato species collected by Andrew Mathews (No. *847*) in which the provenience data is incomplete, reading simply "Peruvia 1834-40." In the opinion of the present author, this specimen represents *S. cantense*. However, as will be explained more fully below, a degree of caution is needed in dealing with Mathews' No. *847* for this is what taxonomists term a mixed collection, consisting of more than one herbarium sheet and more than one species.

One of Mathews sheets forms the type collection of *S. wittmackii* Bitter. In his original diagnosis, Bitter cites this particular specimen as coming from "Lomas of Amancaes, near Lima, July 1833."

Another one of Mathews' collections, housed in the Herbarium of the University of Cambridge in Great Britain, consists of two plants mounted on a single sheet. Plant No. 1 corresponds to the type collection of *S. wittmackii* Bitter

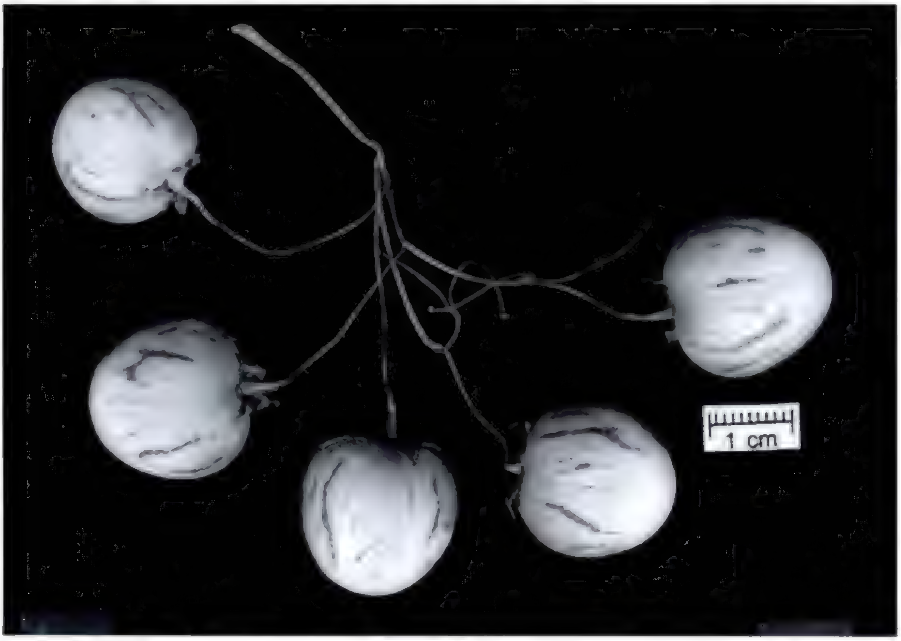


Figure 174. Fruits of *Solanum cantense* (*Ochoa 14828*).

(=*847 pro parte*); whereas Plant No. 2, in the opinion of the author, is referable to *S. cantense* (not *S. piurae* as recorded by Correll, 1962). Moreover, Plant No. 2 is identified on the sheet as *Mathews 771* (from Cuesta de Puruchuca [Puruchuco], collected April, 1832). Duplicates of *Mathews 771* are found in the Fielding Herbarium of the University of Oxford, the Herbarium of the Royal Botanical Garden of Edinburgh and the Herbarium of the Department of Botany at the University of Glasgow.

Affinities

Solanum cantense is more closely related to *S. chiquidenum* than to any other species. Both are alike with respect to corolla color, the size and shape of the calyx, fruit shape and color, the coriaceous texture of the leaves and in the production of moniliform tubers. However, the two species differ notably in plant habit, corolla shape and leaf characteristics. This species is also related to some extent to *S. acroglossum* and *S. piurae*, but the relationships, in this case, are much more remote.

Habitat and Distribution

This species is often found on rocky slopes in poor, gravelly soil, growing either alone or in association with various herbs and shrubs, including *Verbena*, *Opuntia* and plants of the grass, composite and pineapple families. It occurs primarily in temperate to cool environments at altitudes between 2500 and 3300 m.

Presently, *S. cantense* is known only from the Peruvian Departments of Ancash, La Libertad and Lima (Map 16).

Specimens Examined

Department Ancash

Province Aija: Casablanca, 3100 m alt., above Cacap, about 4 km from Huayán on the Huayán-Tacarpo pedestrian trail, plants with stems sparsely pilose including the rachis on the lower surface of the leaf, flowers white, 7 April 1970, *C. Ochoa 2723* (MOL, GH, OCH, US). Casablanca, 3100 m alt., above Cacap, about 4 km from Huayán on the Huayán-Tacarpo pedestrian trail, plants with stems glabrous and vigorous, flowers white, 7 April 1970, *C. Ochoa 2724* (OCH). Aldave, 2350 m alt., heading up the San Miguel-Huayán pedestrian trail, to the east of the road from Huarmey to San Miguel, flowers white, leaves with several interjected leaflets, April 1971, *C. Ochoa 2971* (OCH). Chaupitabla, 3000 m alt., near and above Huayán, on the Huayán-Tacarpo pedestrian trail, plants essentially glabrous, leaves little divided, flowers white, April 1971, *C. Ochoa 2973* (OCH). Chaupitabla, 3000 m alt., between Huayán and Casablanca, on the Huayán-Tacarpo pedestrian trail, plants sparsely pilose on the stems and on the lower surface of the rachis, leaves glabrous above, somewhat pilose on the lower veins, flowers white, April 1971, *C. Ochoa 2974* (OCH). Calchín, 3100 m alt., heading up the pedestrian trail from Huayán to Wuamanwilca, much before Tacarpo, 23 April 1983, *C. Ochoa and A. Salas 15159* (CIP, GH, OCH, US).

Province Pallasca: Urmaca, 2950 m alt., near Huandoval, along the bridle trail from Pallasca to Huandoval, stems and rachis sparsely pilose as in the case of the veins on the lower surface of the leaflets, glabrous above, flowers white, 26 May 1963, *C. Ochoa 2519* (GH, OCH, US).

Department Lima

Province Cajatambo: Lower slopes of Cerro Huarancolca, 3000 m alt., near Churín, 12 April 1960, *C. Ochoa 2295* (OCH). Ruins of Tambo Jirca, 3200 m alt., about 4 km north of Caujul, among plants of *Agave* sp. and *Opuntia exaltata*, associated with *Amaranthus*, *Satureja* and *Viguiera*, flowers white and abundant, April 1982, *C. Ochoa* and *A. Salas 14681*, 2n=24 (CIP, OCH, from original plants, and GH, MOL, US, from plants grown in the greenhouse at Huancayo). Mancocona, 3400 m alt., about 3 km west of Caujul, among stones, flowers white, tubers white-hyaline and small, April 1982, *C. Ochoa and A. Salas 14682*, 2n=24 (CIP, OCH). Uchupauna, 3300 m alt., near Caujul, abundant, among *Agave and Opuntia*, associated with grasses, and between stones of old terraces, flowers white, April 1982, *C. Ochoa and A. Salas 14686*, 2n=24 (CIP, F, OCH).

Province Canta: Cuesta de Puruchuca [Puruchuco], April 1832, *A. Mathews 771 p.p.* (CGE, E, OXF). Capra Marca, 2800 m alt., near Canta, 24 March 1951, *C. Ochoa 1154*, 2n=24 (LE, OCH, type collection of *S. cantense*). On rocky open slope, along road above Canta, 3300 m alt., plant rigidly erect, glabrous and vernicose throughout, flowers pure white, rotate, tubers brittle, ellipsoid, 2 cm long, 7 March 1958, *D.S. Correll, E.E. Smith and R. Ferreyra P-290*, sheets 1-2 (LL). Vicinity of Canta, 3000 m alt., on stony slopes in poor sandy-clay soils, 12 April 1958, *C. Ochoa 2153* (OCH). Heading down from Huamantanga toward the Lima-Canta trunk road, 2400 m alt., about 14 km before Puente San José, April 1964, *C. Ochoa and J.G. Hawkes 2576* (OCH). Between Boquellón and Paucocha, 3100 m alt., heading up the Lima-Canta road detour, toward Huamantanga, among large rocks, stems glabrous, leaves with shining leaflets and revolute margins, flowers white, 21 March 1971, *C. Ochoa 2958* (GH, NY, MOL, OCH, US) and *2959* (OCH). Between Boquellón and

Paucocha, 3100 m alt., heading up the Lima-Canta road detour, toward Huamantanga, plants with stems sparsely pilose, leaves shining, leaflets glabrous with revolute margins, flowers white, 21 March 1971, C. *Ochoa 2960* (OCH). San Miguel, 2900-3000 m alt., almost facing Obrajillo, in stony soils, herb with white flowers, fruits light green with darker green streaks, 12 April 1974, *G. Vilcapoma S. 209* (OCH, USM). Acochaca, 3000 m alt., above the town, lower slopes of the Cordillera Viuda, in stones, n.v. *Papa de Abuelo*, leaves shiny green and glabrous, tubers small and white-hyaline, 12 April 1974, *G. Vilcapoma S. 210* (OCH, USM). Wuallincocha, 3200 m alt., east of Canta, April 1978, *C. Ochoa and A. Salas 12525* (CIP, MOL, OCH). Lachaqui, 3140 m alt., ca. Anza, in thickets in a moist quebrada, flowers creamy white, n.v. *Papa de Gentil*, 1 May 1993, *G. Vilcapoma 2352* (MOL, OCH).

Province Huaral: Yarojo Punco, 3000 m alt., heading up from Ravira to Pacaraos, near Pacaraos, on stony slopes, April 1982, C. *Ochoa 14692* (CIP, OCH).

Province Huarochirí: Matucana, about 8000 ft., grassy and shrubby slope, berries whitish with green lines, 12 April-3 May, 1922, *MacBride and Featherstone 412* (F). Matucana, about 8000 ft., wet densely shrubby slope, corolla white, 14-18 March 1923, *J. Francis MacBride 2954* (F). Near km 91 on the central Lima-La Oroya road, a little before the second tunnel connecting both sides of the Rímac River, among grasses and other small plants, plants 0.60 to 1.30 m, stems pigmented at base, flowers white and large, leaves shiny green, 1 April 1972, *Z. Huamán and J. Bryan 302* (CIP, OCH). Forest of Zárate, 3090-3150 m alt., on hillsides in middle temperate forest, flowers white, 3 March 1976, *Nils Valencia 053* (USM). Near Zárate, 2700 m alt., heading up from San Bartolomé toward the "Forests of Zárate", on stony slopes, plant herbaceous, tuberous, leaves vernicose, corolla pure white, rotate, March 1975, C. *Ochoa 7412* (OCH). Between Chinchín and Tupicocha, 3300 m alt., among stones, flowers white, 11 April 1982, *J. White s.n.* (OCH). Tupicocha, 3200 m alt., between Cocachacra and San Damián, flowers white, tubers 1-2 cm long, round to ovoid, single or moniliform, 24 April 1982, C. *Ochoa and A. Salas 14720* (CIP, GH, MOL, OCH, US). Cullu Chupa, 3000 m alt., in the Quebrada de Cerro San Felipe, heading up the central road from Lima toward San Mateo, via the Collata detour, entering by the left side of the Quebrada de Matucana. Only berries of dry plants were collected, growing with *Stipa*, *Bidens* and abundant *Siphocampylus*, 7 May 1982, C. *Ochoa and P. López Camarena 14746* (CIP, MOL, OCH, from plants grown in the greenhouse at Huancayo). Near Collata, 2850 m alt., heading up the central road to Matucana and afterward by foot along the left side of the Quebrada de Matucana toward Collata. Only berries were collected, 20 May

1982, *C. Ochoa and P. López Camarena 14826*, 2n=24 (CIP, OCH, from plants grown in the greenhouse at Huancayo) and *14828* (CIP, MOL, OCH, USM, from plants grown in the greenhouse at Huancayo).

Province Yauyos: Pampas, near Yauyos, 3000 m alt., very scarce, flowers white, 15-18 March 1965, *C. Ochoa 2610* (OCH). Between Huanturo and Tunuco, on the road to Tupe, 3000 m alt., very scarce, flowers white, leaves shining and glabrous, 26 March 1975, *C. Ochoa and D. Bauman 7431* (OCH). Paluche, 2859 m alt., Quebrada de Cunyacc, near Cacra, 7 April 1975, *D. Bauman s.n.* (OCH). Lower slopes of Cerro Quilca, 3000 m alt., between Tamará and Ayaviri, about 15 km northeast of Omas, on the Omas-Quinches road, leaves large, with or without several interjected leaflets, flowers white, 5-7 April 1982, *C. Ochoa 14664* (OCH) and *14665* (CIP, GH, OCH, US).

Localidad indefinida: Possibly from Cuesta de Puruchuco, 1834-1840, *Mathews 847 p.p.* (GH).

Table 45. Fertility of *Solanum cantense* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	PIURANA	× *S. hypacrarthrum*	6(5)	0(0)	0(0)
24	1	TUBEROSA	× *S. mochiquense*	22(25)	0(2)	0(0)
			× *S. trinitense*	10	0	0
			× *S. wittmackii*	15(6)	0(0)	0(0)
24	2	CONICIBACCATA	× *S. chomatophilum*	26(29	0(7	0(58
			× *S. contumazaense*	15(9)	0(0)	0(0)
24	2	PIURANA	× *S. chiquidenum*	13(15)	2(0)	0(0)
24	2	TUBEROSA	× *S. coelestispetalum*	5	4	51
			× *S. marinasense*	5	4	36
			× *S. medians* *var. autumnale-2x*	19(30)	1(6)	66(35)
			× *S. multiinterruptum*	12	1	5
			× *S. sparsipilum*	5(8)	5(0)	0(0)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

The results of experimental crosses involving *S. cantense* and various diploid species of EBN=1 and 2 are given Table 45; whereas the species used in this crossing program are listed in Table 46.

The unilateral cross of *S. cantense* with *S. trinitense* (EBN=1) and the reciprocal crosses of this species with *S. chiquidenum*, *S. contumazaense* and *S. sparsipilum* (the last three with EBN=2) all ended in failure. On the other hand, reciprocal crosses of this species with diploid *S. medians* (EBN=2) were highly successful. But, when plants of *S. cantense* were crossed with *S. chomatophilum* (EBN=2), seed was obtained only when this species was used as the female parent.

It is also interesting to note the ease by which unilateral crosses between *S. cantense* and two allopatrically distributed EBN=2 species, *S. coelestispetalum* and *S. marinasense*, were accomplished. The unilateral cross with *Solanum multiinterruptum*, on the other hand, a species which is sympatric with *S. cantense*, was made only with some difficulty.

The incompatibility shown by *S. cantense* (EBN=2) in crosses with *S. hypararthrum*, *S. mochiquense*, *S. wittmackii* and *S. trinitense* (all ENB=1) is readily understandable in terms of their different EBN values. Factors other than the numerical endosperm balance, however, must be taken into account in explaining the failures of the reciprocal crosses of *S. cantense* with *S. chiquidenum*, *S. contumazaense* and *S. sparsipilum*, all of which are EBN=2.

Table 46. Collections (OCH) used in *Solanum cantense* fertility studies.

CONICIBACCATA
S. chomatophilum 11061, 13012, 13201
S. contumazaense 14751

PIURANA
S. cantense 14228, 14664, 14681
14692, 14746, 14826, 14828
S. chiquidenum 13963, 13965A
S. hypacrarthrum 14715, 14731

TUBEROSA
S. coelestispetalum 7711
S. marinasense 11618
S. medians-2x 11259
11884, 13243, 13270
S. mochiquense 14820, 14870, 15995
S. multiinterruptum 11693, 14718
S. sparsipilum 13774
S. trinitense 13968
S. wittmackii 13271, 14687

36. *Solanum chiquidenum* Ochoa, Biota (Lima) 1:5, Figs. 1-2, 1954.

Figs. 175-179; Map 17; Plate XVII.

S. chiquidenum Ochoa var. *cachicadense* Ochoa, Agronomía (Lima) 26:318, 1959. **Type:** PERU. Department La Libertad, Prov. Santiago de Chuco, Cerro Botica, near Cachicadán, 3020 m alt., 13 May 1952, *C. Ochoa 1469* (OCH).

S. chiquidenum Ochoa var. *porconense* Ochoa, Agronomía (Lima) 27:369, illustr., 1960. **Type:** PERU. Department Cajamarca, *jalcas* of Hacienda Porcón, above the hamlet, 14 May 1960, *C. Ochoa 2340* (OCH).

Plant erect or erect-ascending, (25-)50-70 (-150 cm or more) tall, stoloniferous and tuber-bearing. Stem cylindrical, slightly woody in the basal one-third of its length, usually simple or little branched, 5-7(-14) mm in dia. at base; internodes (2-3-)6-7(-9-16) cm long, light green or slightly pigmented, occasionally dark purple, very sparsely pilose with short, coarse, pointed hairs. Stolons 40-50 cm long, simple or rhizomatous. Tubers white, small, 1-2 cm in dia., round or slightly compressed, moniliform (Fig. 178). Leaves imparipinnate or simple at base, with (0-)1-2(-3) pairs of leaflets and 0-1 pairs of very small interjected leaflets, often with but 1 pair of leaflets and lacking interjects. Leaves (5.5-7.5-) 12.0-18.0(-22.0-27.5) cm long by (3.2-4.5-)9.0-12.0(-20.0) cm broad, coriaceous or subcoriaceous, opaque or somewhat vernicose, sparse and coarsely hispid, especially on the upper margins; petioles (1.5-2.5-)4.5-6.0(-7.0) cm long. Leaflets sessile or very shortly petiolulate, lanceolate or elliptic-lanceolate to ovate-lanceolate, rarely ovate, margins strongly hispid, the apex pointed or acuminate and the base obliquely rounded and slightly auriculate; the first pair sometimes basiscopically slightly decurrent about the rachis; terminal leaflet slightly larger than the laterals, (3.5-)5.0-9.5(-12.0) cm long by (1.3-)2.7-4.0(-6.0) cm broad; first lateral pair of leaflets (2.4-)4.0-7.5(-10.5) cm long by (0.9-)1.8-3.4(-4.5) cm broad. Pseudostipular leaves broadly falcate, 0.5-2.0 cm long by 0.3-1.0 cm broad. Inflorescence cymose-paniculate or cymose, 5-15(-25)-flowered. Peduncle usually short, (2.0-)4.0-7.5(-11.0) cm long, thick, 3 mm in dia. at base, glabrous or sparsely pilose; pedicels 1.5-3.0(-4.0) cm long, articulated 5.0-7.5(-9.0) mm below the calyx. Calyx symmetrical or asymmetrical, 6-8(-9) mm long, glabrous or glabrescent, pigmented, narrowed gradually toward the apex of the pedicel, deeply lobulate; lobes ovate-lanceolate or narrowly ovate, abruptly acuminate at apex; acumens narrow and pointed, 2.0-3.5(-4.5) mm long. Corolla rotate pentagonal to substellate or stellate (in var. *gracile*), 2.6-3.0(-3.5) cm in dia., white to creamy-white with bluish-lavender acumens or pale-violet externally; acumens cucullate, puberulent, with somewhat rounded 7-8 mm-long lobes. Anthers lanceolate, 5.0-

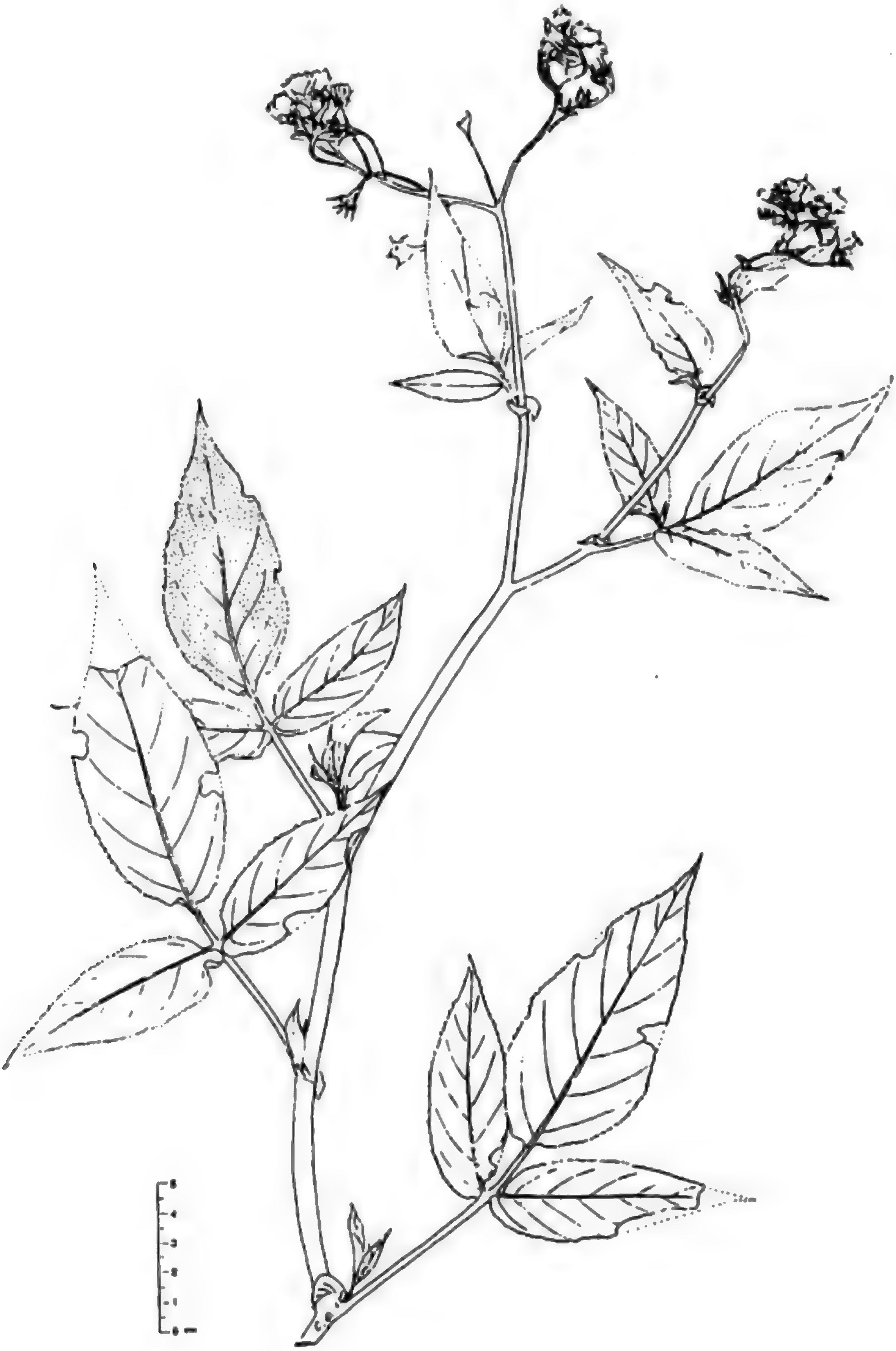


Figure 175. *Solanum chiquidenum* (*Ochoa 1505*, holotype).

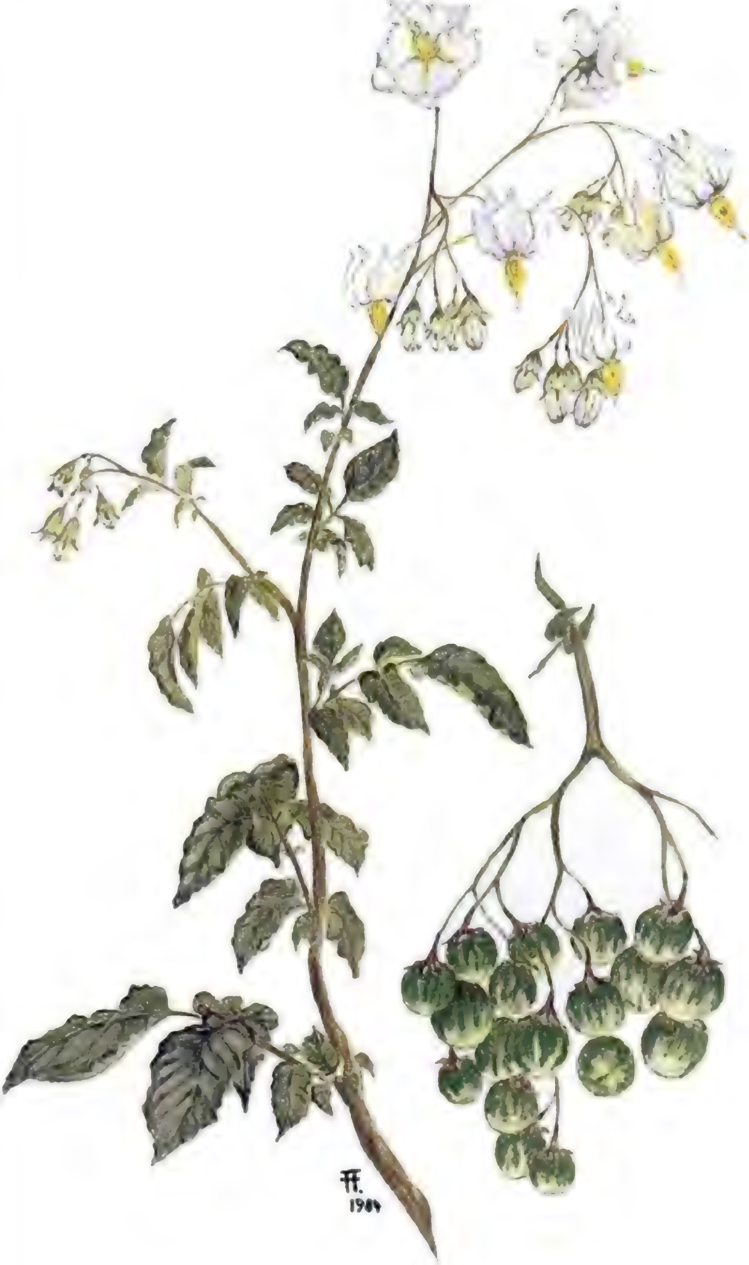


Plate XVII. *Solanum chiquidenum* Ochoa.

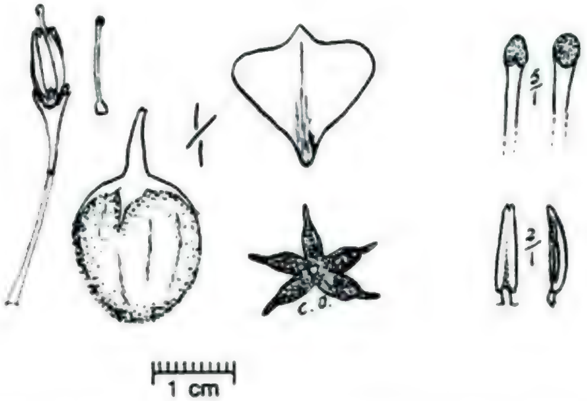


Figure 176. Floral dissection of *Solanum chiquidenum* (*Ochoa 1505*, holotype).

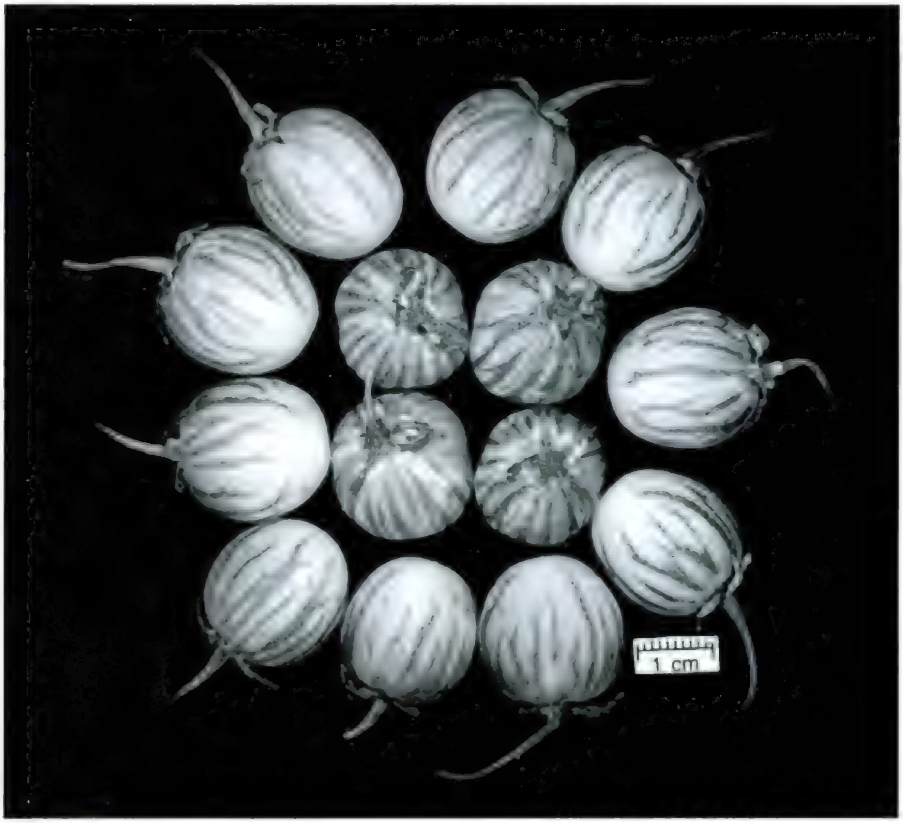


Figure 177. Fruits of *Solanum chiquidenum* (*Ochoa 1505*, holotype).

6.0(-6.5) mm long; base cordate; filaments 1.0-1.5 mm long, glabrous. Style 8.5-9.5(-10.5) mm long, very slender, papillose along the lower two-thirds of its length; stigma capitate, small. Fruits round to ovoid, 1.4-1.8 cm long, light green and marked with darker green streaks. Chromosome Number: 2n=24. EBN=2.

Local Name: *Papa de Zorro*, in the District and Province of San Miguel, Cajamarca.

Type: PERU. Department and Province of Cajamarca, near Chiquidén in the District of San Juan, 2800 m alt., May 1952, *C. Ochoa 1505* (holotype OCH, isotypes MOL, USM).

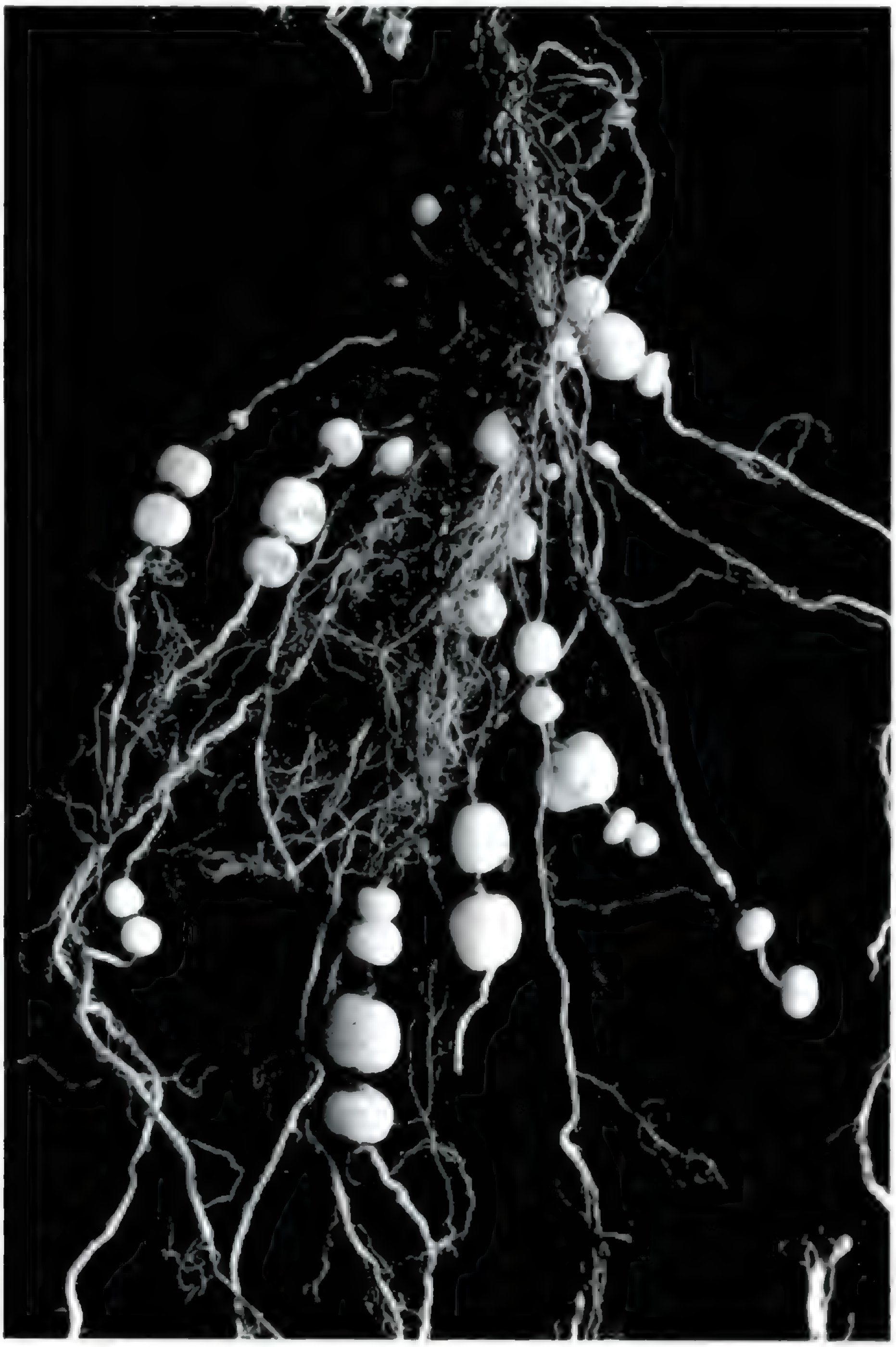


Figure 178. Tuberization of *Solanum chiquidenum* (*Ochoa 1505*, holotype).

As this species is resistant to *Phytophthora infestans* (Ochoa, 1954), it may prove valuable to workers interested in the genetic improvement of the common potato. It is susceptible, however, to the wart disease caused by *Synchytrium endobioticum*.

Affinities

Solanum chiquidenum is closely related to *S. acroglossum*. Both have similar-appearing leaves and fruits, and both have coriaceous leaflets and moniliform tubers. However, the two differ notably in plant habit, leaf pubescence and corolla color, as well as in other floral details.

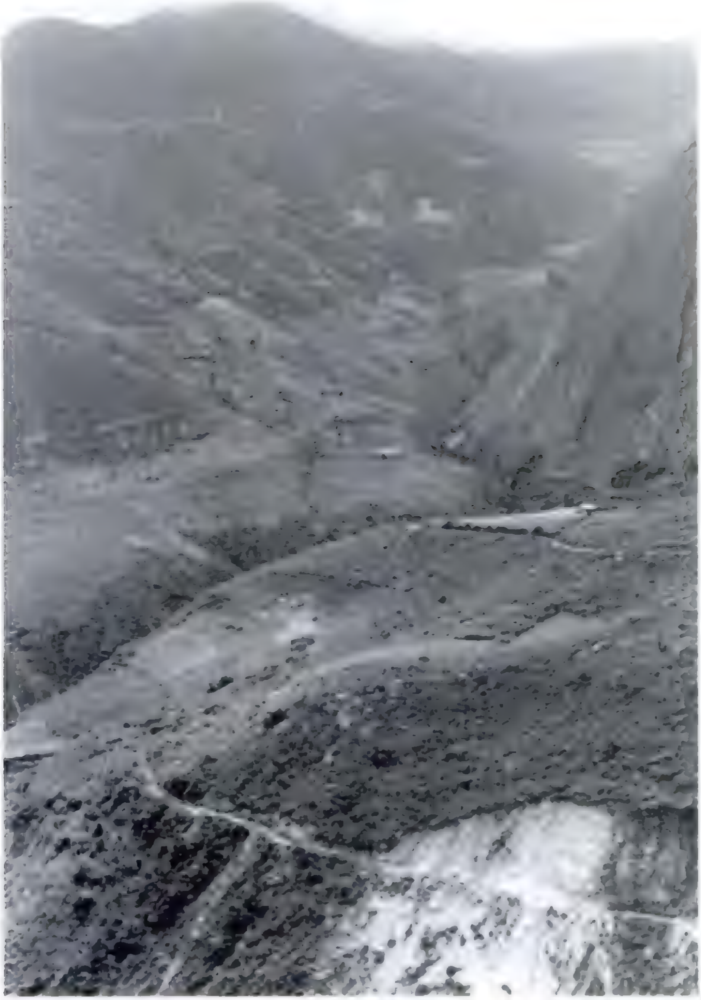


Figure 179. Quebrada Chiquiden, Cajamarca, habitat and type locality of *Solanum chiquidenum*.

This species also shares some features in common with *S. paucissectum* and *S. cantense*. However, the bonds of relationship with these two species are not as strong as with *S. acroglossum*.

Habitat and Distribution

This species grows in the mountains of the interandean region of northern Peru in fairly cool climates, preferring altitudinal zones between 2500 and 3200 m. However, it also occurs, although less frequently, in temperate valleys between 1500 and 2000 m altitude, as well as in high, cool *jalca* habitats between 3400 and 3700 m.

Presently, this species is known only from the Departments of Ancash, Amazonas, Cajamarca and La Libertad, in northern Peru (Map 7).

The label on one collection of *S. chiquidenum* (*D. and V. Ugent 5401-14*) states that this species grows along stream banks between Cajamarca and Pedernal together with a number of other herbaceous genera, including *Desmodium*, *Oenothera*, *Cuphea*, *Astragalus*, *Calceolaria*, *Brassica*, *Epilobium*, *Trifolium*, *Rumex*, *Lupinus*, *Erodium*, *Equisetum*, *Veronica*, *Thalictrum*, *Lepidium*, *Stipa* and *Solanum chomatophilum*. Another collection (*Ochoa & Hawkes 2551*), obtained from a shrub thicket near Hacienda Motil in the Department of La Libertad, reports that the species at this locale is associated with *Rubus*, *Desmodium*, *Lupinus*, *Calceolaria*, *Verbena* and *Poa*.

Specimens Examined

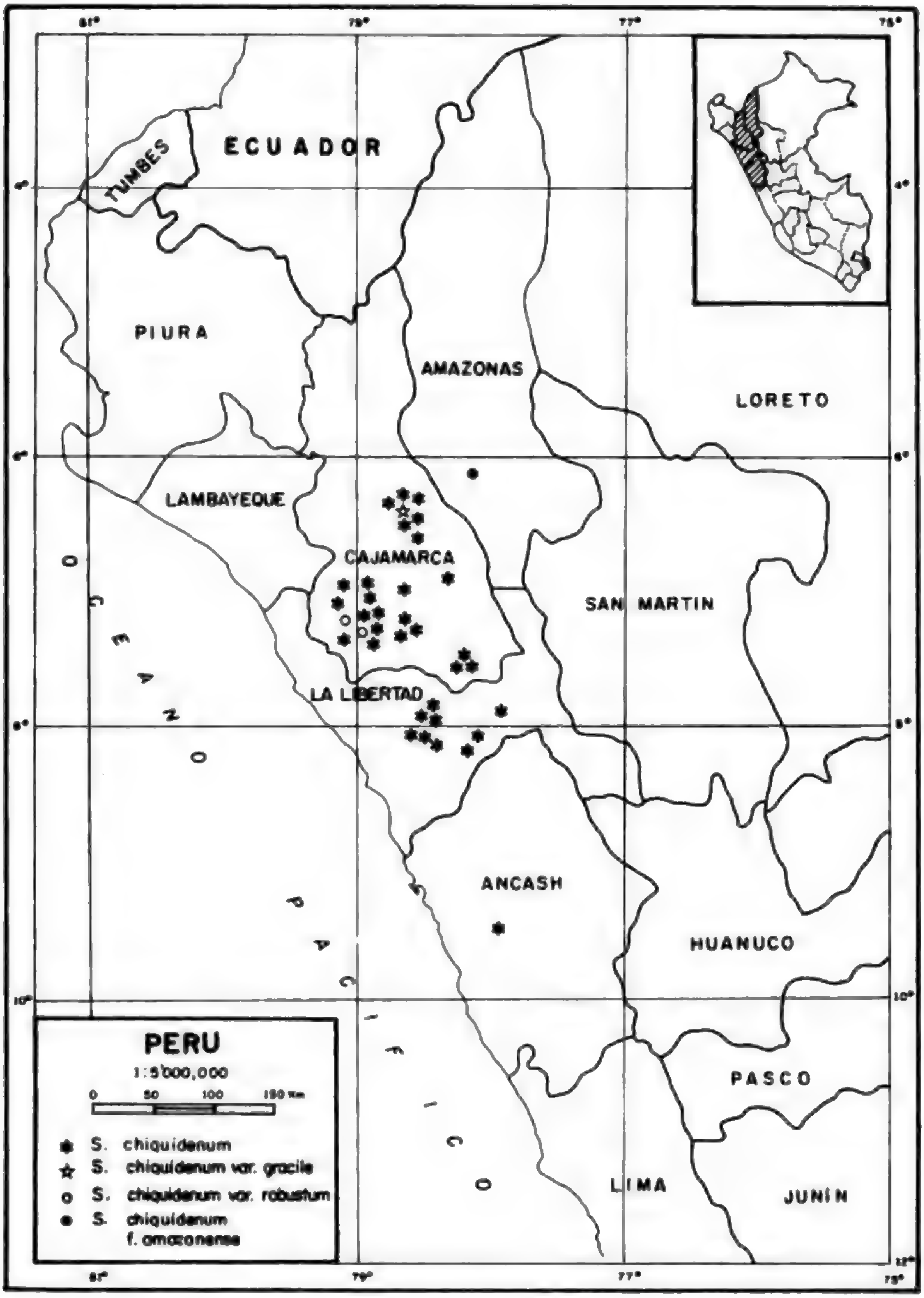
Department Ancash

Province Huaraz: In open grassy-bushy slope about 5 km below Jupash, 2900 m alt., flowers white, rotate-substellate, leaves glossy green above, tubers white, pyriform, 2.5 cm long, 28 March 1960, *D.S. Correll and E.E. Smith P947* (LL).

Department Cajamarca

Province Cajabamba: San Nicolás, 3000 m alt., near Cajabamba, April 1978, *C. Ochoa and A. Salas 12543* (CIP, OCH). Pingo, 3000 m alt., above Cajabamba, April 1978, *C. Ochoa and A. Salas 12544* (CIP, MOL, OCH, USM). Cuchucorral, 2600 m alt., near Cajabamba, April 1978, *C. Ochoa and A. Salas 12545* (CIP, OCH, USM). Pata, 3000 m alt., near Cajabamba, April 1978, *C. Ochoa and A. Salas 12546* (CIP, GH, MO, MOL, OCH, US, USM).

Province Cajamarca: Chiquidén, 2800 m alt., near Lanchi, between San Juan and Gavilán Pass, 17 May 1952, *C. Ochoa 1505* (MOL, OCH, USM, type



Map 17. Distribution of *Solanum chiquidenum, S. chiquidenum* var. *gracile, S. chiquidenum* var. *robustum* and *S. chiquidenum* f. *amazonense*.

collection of *S. chiquidenum*) and *1506* (paratype OCH). About 15 km from Cajamarca, on road to Bambamarca, 3000 m alt., on bushy slopes along small stream, plants robust, deep green and much branched; tubers moniliform, flowers white with light lavendar on outer surface, 25 March 1960, *D.S. Correll* and *E.E. Smith P854* (NY, LL-sheets 1 and 2). About 25 km from Cajamarca, on road to Bambamarca, 3400 m alt., on bushy slopes, plants erect, 25 March 1960, *D.S. Correll and E.E. Smith P855* (LL). Near headquarters of Hacienda Porcón, 3200 m alt., north of Cajamarca, along rocky-grassy stream bank, plants robust, 25 March 1960, *D.S. Correll* and *E.E. Smith P877* (LL). *Jalcas* on the Hacienda Porcón, in grassland, 3400 m alt., flowers white, 2 April 1960, *C. Ochoa 2288* (OCH). *Jalcas* on the Hacienda Porcón, above the farm hamlet, 3300 m alt., 14 May 1960, *C. Ochoa 2340* (OCH). Km 28 NW of Cajamarca on road to Pedernal, and 12 km west from this point to Hacienda Granja Porcón, 3260 m alt., growing on steep banks of small stream, 6 June 1963, *D. and V. Ugent 5401* sheets 1, 2 (WIS); *5403* sheet 1 (WIS), sheet 2 (OCH); *5406* sheets 1, 2 (WIS); *5407* sheets 1, 3 (WIS); *5408* sheets 1, 3, 4 (WIS); *5410* sheets 2, 3, 4 (WIS); *5411* sheets 1, 2, 3, 4 (WIS); *5412* sheet 1 (WIS); *5413* sheets 1, 2 (WIS) and *5414* sheets 2, 3 (WIS). Chimola, 3350 m alt., between Porcón and Cajamarca, 29 March 1964, *C. Ochoa* and *J.G. Hawkes 2566* (CIP, OCH). Near Chiquidén, 2850 m alt., between San Juan and Paso del Gavilán, 30 March 1964, *C. Ochoa* and *J.G. Hawkes 2568* (topotype OCH). Lanchi, 2700 m alt., near Chiquidén, between San Juan and Chiquidén, upward toward Gavilán Pass, 30 March 1964, *C. Ochoa and J.G. Hawkes 2569* (OCH). Cerro Negro, 3100 m alt., on the San Juan-Cajamarca road, 2 km before Chiquidén, March 1969, *N. Capurro s.n.* Above San Juan, 3000 m alt., near a waterfall, between rock crevices, 1 April 1976, *C. Ochoa 10719* (OCH) and *10720* (OCH). Cerro El Miradero, 2800 m alt., near Huayabo, above Magdalena, flowers white with bluish acumens, 1 April 1976, *C. Ochoa 10721* (CIP, OCH). Batán, 2700 m alt., detour from San Juan to Sunchubamba, among abundant colonies of *Rubus* sp., April 1978, *C. Ochoa and A. Salas 12537* (CIP, MOL, OCH, US, USM). Near Sunchubamba, 2300 m alt., April 1978, *C. Ochoa and A. Salas 12541* (CIP-fragment, OCH). Chiquidén, 2700 m alt., near the lower slopes of Cerro Yumagual, District San Juan, 20 May 1982, *C. Ochoa 14800* (topotypes CIP, F, OCH, US, WI). Cumbe Mayo, 3500 m alt., within vegetation of herbs and grasses, leaves hirsute-pubescent, 30 April 1983, *I. Sánchez V. 2924* (UNTC). Farm Cooperative of Porcón, near the Quebrada Peña Blanca, 3200 m alt., June 1984, *C. Ochoa 15840* (CIP, OCH, UNTC). Farm Cooperative of Porcón, middle slopes of Cerro Chilincaga, 3400 m alt., June 1984, *C. Ochoa 15841* (CIP, OCH, USM, UNTC). Cerro Alegre, 3250 m alt., between Porcón and San Pablo, April 1992, *C. Ochoa and A. Salas 16000* (CIP, OCH). Huaquín, 3200 m alt., facing Cerro Alegre, between Porcón and San Pablo, April 1992, *C. Ochoa and A. Salas 16006* (CIP, MOL, OCH).

Province Contumazá: Between Cascas and Contumazá, 2250 m alt., 19 May 1962, A. *López, A. Sagástegui and I. Sánchez 3703* (HUT, OCH). Above Contumazá on the road to Cascas, 2680 m alt., 20 May 1962, *A. López, A. Sagástegui and I. Sánchez 3715* (F, HUT, OCH). Cerro Chungarrán, near Guzmango, 2900 m alt., August 1976, C. *Ochoa 11059*, 2n=24 (CIP, MOL, OCH, US). Las Campanillas, 2700 m alt., Guzmango, on stony hillsides, flowers white, n.v. *Papa de Zorro*, 23 May 1978, *A. Sagástegui and J. Mostacero 9147* (HUT, OCH). Lower slopes of Cerro Chungarrán, near Guzmango, 2700 m alt., April 1978, *C. Ochoa and A. Salas 12516* (CIP, OCH). Near Juque, 2850 m alt., between Cajón and Ventarrón, along the railroad from Trinidad to San Lorenzo, flowers creamy white, 10 May 1980, *C. Ochoa 13963*, 2n=24 (CIP, MOL, OCH, US, USM, from plants grown in the greenhouse at Huancayo). Near Juque, 2850 m alt., between Cajón and Ventarrón, along the railroad from Trinidad to San Lorenzo, within thicket or scrub with *Passiflora* and associated with grasses. Although the leaves, in general, are little divided, some plants have a leaf dissection that is more accentuated, 10 May 1980, *C. Ochoa 13964*, 2n=24 (CIP, MO, MOL, NY, OCH, US, USM). Cajón, 2850 m alt., near Juque, on the Contumazá to Trinidad road (growing near *Solanum trinitense Ochoa 13965)*, specimens grown in the greenhouse at Huancayo from tubers collected originally 10 May 1980, *C. Ochoa 13965A* (CIP, OCH, US, from plants grown in the greenhouse at Huancayo). Lledén, 2700 m alt., on the Cascas-Contumazá road, 13 May 1980, C. *Ochoa* and A. *Salas 13972*, 2n=24 (CIP, MOL, OCH, US, original collection); (CIP, OCH, US, from specimens grown in the greenhouse at Huancayo) and (CIP, OCH, from plants grown in the field at Huancayo). Cerro Cunantén, 2900 m alt., between Lledén and Contumazá, inflorescences seen with 30 or 40 white flowers, 13 May 1980, C. *Ochoa 13973*, 2n=24 (CIP, NY, MOL, OCH, US). Cerro Chungarrán, 2700-2800 m alt., near Guzmango, plants large and branched, more than 1 m tall, very floriferous, 14 May 1982, *C. Ochoa 14750*, 2n=24 (OCH). Above Cascas, 2600 m alt., before the Contumazá tunnel on the Trujillo-Contumazá road, near Chorrillo and La Ramada, leaves vernicose, coriaceous; flowers white with slight tinge of blue toward the acumens of the corolla, May 1982, C. *Ochoa 14754* (OCH). Lower slopes of Cerro Cunantén, 2900 m alt., near La Ramada on the Trujillo-Contumazá road, corolla pure white, growing among bromeliads and cacti, in rock areas, May 1982, *C. Ochoa 14756* (CIP, OCH). Lower slopes of the western side of Cerro Cunantén, 2900 m alt., on the Trujillo-Contumazá road, between Chorrillo and La Ramada, May 1982, C. *Ochoa 14762* (OCH). San Lorenzo, 2500 m alt., tuberous, flowers white, n.v. *Papa de Zorro*, 14 June 1983, *A. Sagástegui and S. López M. 10665* (HUT, OCH). Environs of Guzmango, 2400 m alt., among rocks, tuber-bearing herb with white flowers, n.v. *Papa de Zorro*, 21 April 1984, *A. Sagástegui 11421* (HUT, OCH).

La Cuchilla, 2000 m alt., above Yetón, April 1992, C. *Ochoa and A. Salas 16178* (CIP, MOL, OCH, US, USM). Cerro Andalay, 1580 m alt., near San Benito, April 1992, C. *Ochoa and A. Salas 16179* (CIP, OCH). Nondón, 2500 m alt., among scrub and herbs, 26 April 1995, C. *Ochoa and A. Salas 16240* (CIP, MOL, OCH, US, USM).

Province Cutervo: Cerro Cruz-Loma, near the Socota mine deposits, 2800 m alt., flowers white, 28 April 1972, C. *Ochoa* and C. *Carrasco 3302* (OCH). Between Sumidero and Chigrip, 3000 m alt., flowers white, 6 March 1973, C. *Ochoa 3607* (OCH). La Colca, 2650 m alt., on shruby hillsides near Socota, flowers white, corolla rotate-pentagonal or pentagonal, May 1977, C. *Ochoa 11671*, 2n=24 (CIP, OCH). Valle Grande, 2500 m alt., between Santa Rosa de Tingo and Laguna Negra on the road from Lucma to Pampa Rioja, in natural grassland with abundant *Rumex*, corolla pure white, rotate-pentagonal or pentagonal, leaves dark green, berries round to ovoid, marbled light green with darker green stripes, 2 June 1983, C. *Ochoa and A. Salas 15230*, 2n=24 (GH, MOL, OCH, US, USM, UNTC).

Province Chota: Coñorpata, 3000 m alt., Cuyumalca Ranch, near Chota, on the Bambamarca-Chota road, 22 May 1952, C. *Ochoa 1534*, 2n=24 (OCH). Lipiac, 3000 m alt., Ranch El Potrerillo, near Chota, on the Bambamarca-Chota road, n.v. *Papa de Zorro*, 22 May 1952, C. *Ochoa 1535*, 2n=24 (OCH).

Province Hualgayoc: Upper slopes of Cerro El Mirador, 3800 m alt., heading down from Hualgayoc toward Bambamarca, flowers white, 22 May 1952, C. *Ochoa 1524* (MOL, OCH). Bambamarca, 2700 m alt., between Sunchubamba and Campodén, in tall forests in very moist and organically rich soil, without flowers, April 1978, C. *Ochoa and A. Salas 12542* (CIP, GH, MO, MOL fragments, OCH, US, USM). Ccolquerumi, 3100 m alt., heading down from Hualgayoc toward Bambamarca, April 1978, C. *Ochoa and A. Salas 12566* (CIP, MOL, OCH, USM). Near Perlamayo, 3100 m alt., on the road to Chugur, April 1978, C. *Ochoa and A. Salas 12568* (CIP, GH, MO, MOL, OCH, US, USM). Las Quinuas, 2900 m alt., near Chugur, April 1978, C. *Ochoa and A. Salas 12569* (CIP, GH, MO, MOL, OCH, US, USM).

Province San Miguel: Quebrada Honda, 3000 m alt., on the road from Hualgayoc to San Miguel de Pallaques, vía Uchuquinua, 25 March 1971, C. *Ochoa 2963*, 2n=24 (OCH, from plants grown at the Universidad Nacional Agraria La Molina, Lima). El Tingo (Agua Blanca) [near Unión Agua Blanca], 2700 m alt., n.v. *Papa de Zorro*, tuber-bearing herb with white flowers, 12 May 1977, *A. Sagástegui*, *E. Alvítez* and *J. Mostacero 8808* (F, HUT). Sabana, 2700 m alt., between Cajamarca and San Miguel, April 1978, C. *Ochoa and A. Salas 12571* (CIP, MOL, OCH, US, USM). Membrillar, 2700 m alt., near Piedra Grande, heading up from La Florida toward Niepos, very floriferous, up to 40 white flowers per inflorescence, May 1982, C. *Ochoa 14765* (CIP, OCH, US).

Province San Pablo: Above San Pablo, 2470 m alt., on rocky hillsides, annual herb with white flowers, 22 May 1975, *A. Sagástegui A., J. Cabanilla and O. Dios 7937* (HUT, OCH). Cerro San Pedro, 2300 m alt., near Cajamarca, April 1978, *C. Ochoa and A. Salas 12548* (CIP, MOL, OCH).

Department La Libertad

Province Bolívar: High part, above Longotea, 2900 m alt., amid scrub, flowers white, corolla pentagonal, 26 February 1961, *C. Ochoa and F. de la Puente 2350* (GH, MO, MOL, NY, OCH, US, USM).

Province Gran Chimú: San Martín, 2500 m alt., between El Molino and Lledén, in moist soil, n.v. *Gentil Papa*, 25 April 1995, *C. Ochoa and A. Salas 16235* (CIP, MOL, OCH, UNTC, US, USM). Aijadero, 2150 m alt., above Lledén, along the edges of barley fields, flowers white with pale violet acumens, 25 April 1995, *C. Ochoa and A. Salas 16236* (CIP, MOL, OCH, UNTC, US, USM). San Martín, heading down toward El Molino, 2500 m alt., on stony slopes, April 1995, *C. Ochoa and A. Salas 16237* (CIP, MOL, OCH, USM).

Province Otuzco: Heading up to Hacienda Motil, 3400 m alt., via the Salpo-Agallpampa road to Quiruvilca, flowers white with acumens pigmented blue-violet, 12 May 1952, *C. Ochoa 1432* (OCH). Steep hillsides of Cerro San Chicón, 2500 m alt., near km 66 of the Trujillo-Otuzco road, among large rocks and columnar cactus, flowers white, 21 April 1960, *C. Ochoa 2304*, 2n=24 (OCH). Above Hacienda Motil, between 2700 and 3100 m alt., heading up the Salpo-Agallpampa road to Quiruvilca, flowers white with lilac acumens, amid scrub and herbs of *Rubus*, *Desmodium*, *Lupinus*, *Calceolaria*, *Verbena*, etc., 24 March 1964, *C. Ochoa and J.G. Hawkes 2551* (OCH). Laguna San Lorenzo, near Usquil, very scarce, April 1978, *C. Ochoa 12536* (OCH). Highlands of Yamobamba, 3700 m alt., on the Agallpampa-Santiago de Chuco road, corolla rotate, white with acumens lightly pigmented violet externally, leaves light green sub-vernicose, 9 May 1979, *C. Ochoa 13345*, 2n=24 (CIP, GH, MO, MOL, NY, OCH, US, USM). Cerro Sango, 3400-3500 m alt., District Agallpampa, above Hacienda Motil, near km 99 of the Trujillo-Huamachuco road, among rocks and shrubs in black moist soils, plants up to 2 m tall, decumbent, 7 July 1981, *C. Ochoa 14482*, 2n=24 (CIP, MOL, OCH, USM) and *14487*, 2n=24 (CIP, OCH, from plants grown in the greenhouse at Huancayo).

Province Sánchez Carrión: In briar thickets along stream, near km 212 from Trujillo, between Huamachuco and Cajamarca., 3050 m alt., flowers white, rotate-pentagonal, tubers small, whitish", 27 March 1960, *D.S. Correll* and *E.E. Smith P919* (LL).

Province Santiago de Chuco: Cerro Botica or Cerro de Oro, 3020 m alt., above Cachicadán, n.v. *Papa de Zorro*, 13 May 1952, *C. Ochoa 1469* (OCH, type of *S. chiquidenum* var. *cachicadense*). Cerro Botica or Cerro de Oro, 2820 m alt., above Cachicadán, amid scrub, flowers white, 13 May 1952, C. *Ochoa 1470* (OCH). Cerro Botica, 3050 m alt., facing Cachicadán, among shrubs and large rocks, 23 May 1963, C. *Ochoa 2507*, 2n=24 (OCH, USM). Perejil, 3000 m alt., between Cachicadán and Mumpamba, among grasses and shrubs of *Monnina* sp., 23 May 1963, C. *Ochoa 2508*, 2n=24 (CIP, GH, MOL, OCH, US, USM). Chorro Colorado, 3500 m alt., along the detour from Cachicadán to Mumpamba, 24 May 1963, C. *Ochoa 2511* (CIP, MOL OCH, US). El Peñón, 3300 m alt., between Cachicadán and Las Combas, 24 May 1963, C. *Ochoa 2513* (GH, OCH, US). Cerro Huallío, 3550 m alt., along the railroad from Cachicadán to Angasmarca, on stony slopes, 25 May 1963, C. *Ochoa 2514* (CIP, GH, MOL, OCH, US). Cuspinga, 3350 m alt., near Huacas Corral, about 7 km to the northwest of Angasmarca, 25 May 1963, C. *Ochoa 2516* (OCH).

Table 47. Fertility of *Solanum chiquidenum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	LIGNICAULIA	× *S. lignicaule*	7	2	0
24	1	MEGISTACROLOBA	× *S. dolichocremastrum*	5(27)	5(25)	0(0)
24	1	PIURANA	× *S. hypacrarthrum*	14(12)	0(0)	0(0)
24	1	SIMPLICISSIMA	× *S. guzmanguense*	15	0	0
24	1	TUBEROSA	× *S. mochiquense*	16(13)	4(0)	0(0)
			× *S. trinitense*	15	12	208
24	2	CONICIBACCATA	× *S. chomatophilum*	11(12)	8(7)	7(3)
24	2	PIURANA	× *S. acroglossum*	4(20)	2(5)	0(27)
			× *S. cantense*	15(13)	0(2)	0(0)
			× *S. piurae*	6(58)	4(35)	0(0)
24	2	TUBEROSA	× *S. bukasovii*	9(25)	7(11)	0(18)
			× *S. phureja*	4(22)	1(7)	0(56)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

The results of crosses of *S. chiquidenum* with diploid species (2n=24) of EBN=1 and EBN=2 are given in Table 47, while the materials used in these experiments are shown in Table 48.

With the exception of the unilateral cross of *S. chiquidenum* (EBN=2) with *S. trinitense* (EBN=1), which turned out to be extraordinarily successful (208 seeds per berry on the average), all other crosses involving this species and diploids having an EBN value of 1 were unsuccessful. Moreover, seeds were not obtained in reciprocal crosses involving this species and *S. piurae* and *S. cantense*, even though all three species are EBN=2. Another surprising result is that only relatively few seeds were obtained in crosses of *S. chiquidenum* with one of its closest relatives, *S. acroglossum*, and then only when the latter was used as the pistillate parent.

With regard to the crosses made between *S. chiquidenum* and the cultivated diploid species *S. phureja*, these were successful only when *S. phureja* was used as the staminate parent. Nevertheless, considering the resistance of *S. chiquidenum* to late blight and the very short tuber dormancy period that is characteristic of *S. phureja*, the very obtaining of such hybrids should be a signal of their potential use to the plant breeder.

Table 48. Collections (OCH) used in *Solanum chiquidenum* fertility studies.

CONICIBACCATA
S. chomatophilum 13201, 13205, 14485, 14791

LIGNICAULIA
S. lignicaule 11316

MEGISTACROLOBA
S. dolichocremastrum 12074, 13013

PIURANA
S. acroglossum 11297
S. cantense 14664, 14692, 14746
S. chiquidenum 13963, 13965A, 15230
S. hypacrarthrum 14715
S. piurae 13954

SIMPLICISSIMA
S. guzmanguense 15991

TUBEROSA
S. bukasovii 9803, 11851, 14333, 14407
S. mochiquense 14820, 14870, 15995
S. phureja 14974, 15071, 15132
S. trinitense 13968

In *Solanum chiquidenum* there can be distinguished two varieties and a form that differ from the typical species principally by the habit and vigor of the plant, the shape and dissection of the leaves and the form of the corolla.

KEY TO THE VARIETIES OF *SOLANUM CHIQUIDENUM*

1. Plant slender; stems delicate; corolla stellate; calyx with short acuminate... lobes; leaves with 3-4 pairs of leaflets, without interjected leaflets .... 36a. *S. chiquidenum* var. *gracile*
1. Plant vigorous; stem thick; corolla rotate; calyx with long acuminate lobes; leaves with 2-3(-4) pairs of leaflets; with interjected leaflets .... 36b. *S. chiquidenum* var. *robustum*

36a. *Solanum chiquidenum* Ochoa var. ***gracile*** Ochoa, Phytologia 77(5):391, 1994. Fig. 180; Map 17.

Plant slender, 70 cm tall. Stem thin, 3-4 mm in dia. at base, usually simple or very little branched, slightly flexed. Leaves 7-11(-12) cm long by 4.5-8.5 (-10) cm broad, with 2-3 pairs of leaflets and without interjected leaflets; leaflets somewhat coriaceous and slightly strigose, narrowly lanceolate 3-5 cm long by 0.7-1.0 cm broad; apex acuminate, narrowly attenuate or rounded at base, sessile or subsessile; margins finely erose. Corolla stellate to substellate, white, 2.5-3.0 cm in dia.; lobes triangular lanceolate, 10-12 mm long by 7-8 mm broad at base. Chromosome Number: 2n=24.

This variety of S. chiquidenum grows in regions of fairly high rainfall and humidity. It is resistant to the attack of Phytophthora *infestans*.

Type: PERU. Department Cajamarca, Province Cutervo, Valle Grande, 2500 m alt., between Sta. Rosa de Tingo and Laguna Negra, 2 June 1983, *C. Ochoa and A. Salas 15229* (holotype OCH, UNTC-fragment).

Specimens Examined

Department Cajamarca

Province Celendín: Lucma, 2400 m alt., between Balsas and Celendín, corolla stellate or substellate, white, leaves with narrowly lanceolate leaflets, April 1978, *C. Ochoa and A. Salas 12559* (CIP, OCH, USM).

Province Contumazá: Cerro Andaloy, 1500-1650 m alt., near San Benito, very scarce, in a small woody thicket among rocks of a talus slope, flowers white, substellate, leaves with narrowly lanceolate leaflets, April 1978, *C. Ochoa and A. Salas 16180* (OCH).

Province Cutervo: Valle Grande, 2500 m alt., between Santa Rosa de Tingo and Laguna Negra, amid scrub and along edges of forest trees, associated with

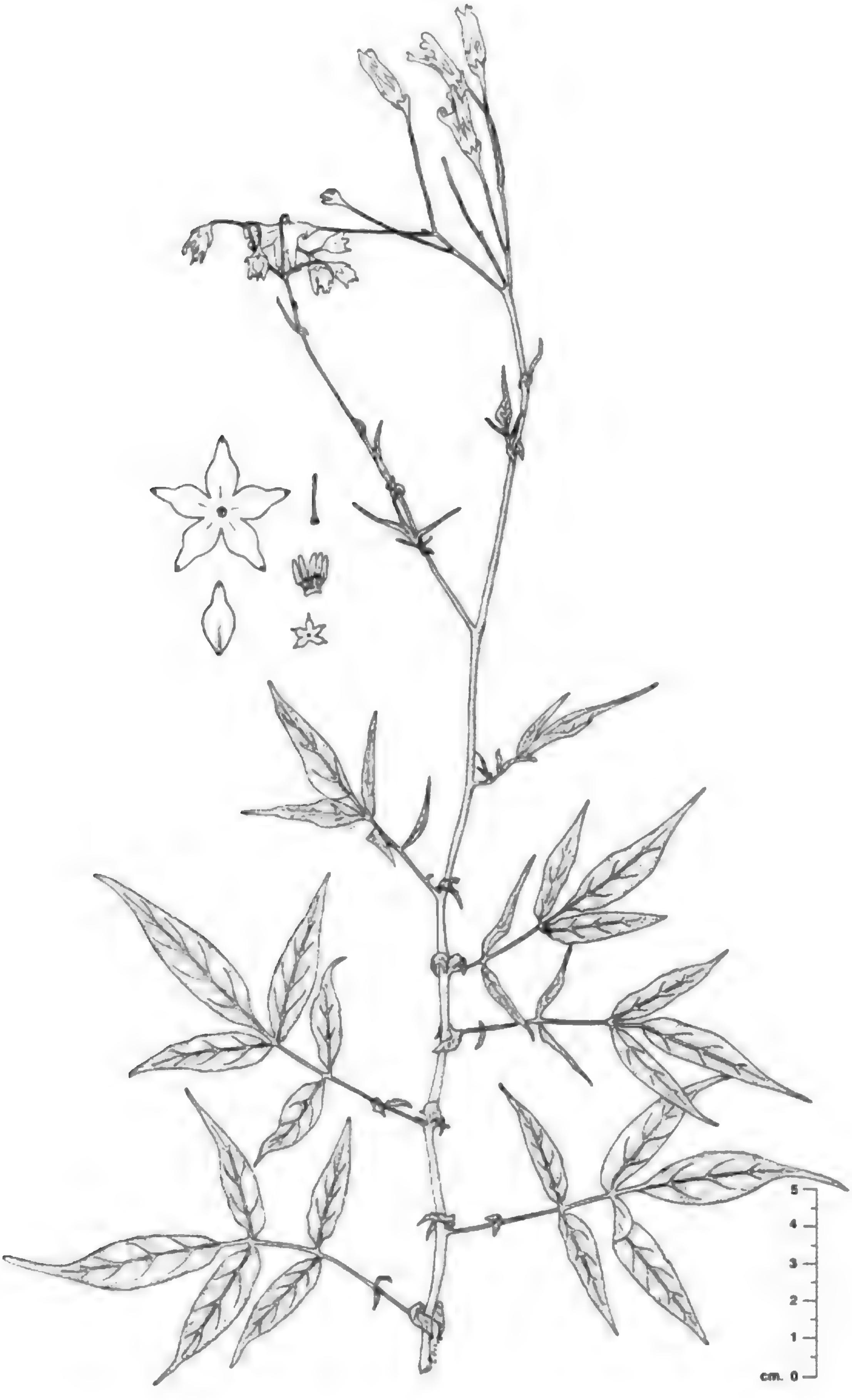


Figure 180. *Solanum chiquidenum* var. *gracile* (*Ochoa and Salas 15229*, holotype).

large tufts of *Suru* (= *Chusquea* sp.), *Calceolarias*, *Begonias* and ferns, plants slender, leaflets narrowly lanceolate, corolla stellate, white, 2 June 1983, *C. Ochoa and A. Salas 15229*, 2n=24 (OCH, UNTC, type collection of *S. chiquidenum* var. *gracile*). Between Santa Rosa de Tingo and Laguna Negra, 2500 m alt., corolla white substellate, tubers moniliform, 2 June 1983, *C. Ochoa and A. Salas 15231*, 2n=24 (OCH). Near La Ramada, 2500 m alt., between Santa Rosa de Tingo and La Ramada, at the edge of a forest of trees and shrubs, corolla white, substellate, 2 June 1983, *C. Ochoa and A. Salas 15240*, 2n=24 (CIP, GH, MOL, OCH, US, USM).

36b. *Solanum chiquidenum* Ochoa var. *robustum* Ochoa, Phytologia 77(5):392, 1994.

Figs. 181-182; Map 17.

Plants to 1.20 m tall; stem erect, very branched. Leaves much larger and more divided than in the typical variety (Fig. 181), with 2-3 pairs of lateral leaflets and 2-4 pairs of sessile interjected leaflets; leaflets coriaceous and sparsely strigose, elliptic-lanceolate, 8.5-9.5 cm long by 4.0-5.5 cm broad, apex pointed or shortly acuminate; base asymmetrically rounded to subauricular, petiolules to 5 mm long; leaflet margins erose and ciliate. Pseudostipular leaves long and broad, to 20 mm long by 10 mm broad. Inflorescence cymose-paniculate, very showy and floriferous (Fig. 181), with 16 cm-long peduncles and 30 or more flowers. Corolla rotate, creamy-white. Chromosome Number: 2n=24.

Type: PERU. Department Cajamarca, Province Contumazá, lower slopes of the western side of Cerro Cunaten, 2900 m alt., between Chorillo and La Ramada, May 1982, *C. Ochoa 14760* (holotype OCH, isotypes CIP, GH, US).

Specimens Examined

Department Cajamarca

Province Contumazá: Lower slopes of Cerro Chungarrán, 2700 m alt., near Guzmango, corolla white, rotate-pentagonal, style long, leaves very segmented, 1 April 1976, *C. Ochoa 10744*, 2n=24 (OCH, CIP, US). Middle Slopes of Cerro Chungarrán, 2950 m alt., near Guzmango, leaves large with up to 3 pairs of large leaflets and up to 4 pairs of interjected leaflets, glabrescent, sub-vernicose and coriaceous, corolla white, rotate to rotate-pentagonal, 12 May 1980, *C. Ochoa 13967*, 2n=24 (CIP, OCH, US). Lower slopes of the western side of Cerro Cunantén, 2900 m alt., between Chorrillo and La Ramada, via the Contumazá road, corolla white, rotate to rotate-pentagonal, berries round, May 1982, *C. Ochoa 14760* (CIP, OCH, GH, US type collection of *S. chiquidenum* var. *robustum*).

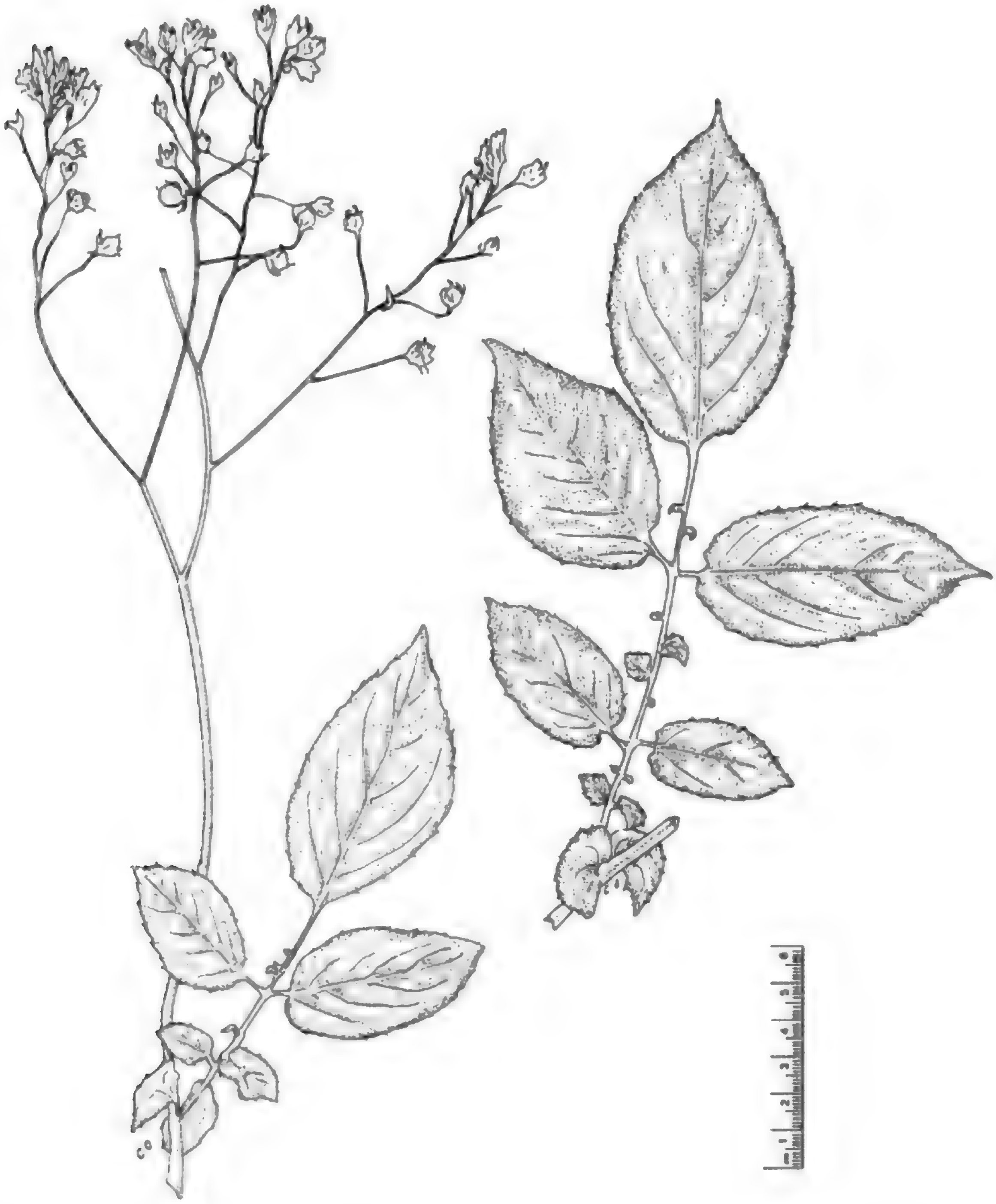


Figure 181. *Solanum chiquidenum* var. *robustum* (*Ochoa 14760*, holotype).

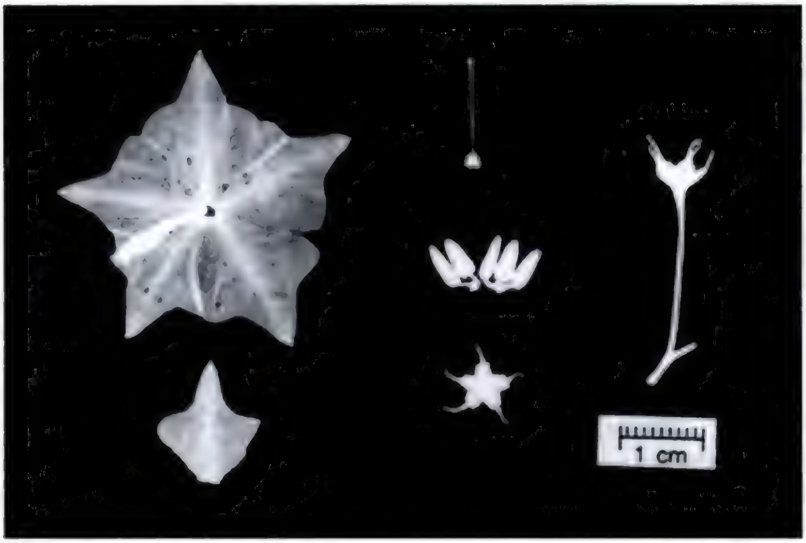


Figure 182. Floral dissection of *Solanum chiquidenum* var. *robustum* (*Ochoa 13967*).

36c. *Solanum chiquidenum* Ochoa f. *amazonense* Ochoa, Phytologia 77(5):392, 1994. Fig. 183-184; Map 17.

Plants much smaller than the typical variety of *S. chiquidenum*; leaves shorter and broader, usually with one enlarged pair of lateral leaves, subsessile; terminal leaflet more broadly elliptic-lanceolate; corolla stellate or substellate, creamy-white (Fig. 184), style short, 8-9 mm long. Chromosome Number: 2n=24.

Type: PERU. Department Amazonas, Province Luya, vicinity of Cuelap, 2800 m alt., in a dense shrub thicket, 15 May 1967, C. *Ochoa 2673*, 2n=24 (holotype OCH).

Specimens Examined

Department Amazonas

Province Luya: Vicinity of Cuelap, 2800 m alt., in a dense shrub thicket, corolla stellate, style short, 8-9 mm long, leaves coriaceous, 15 May 1967, C. *Ochoa 2673* (OCH, type collection of var. *chiquidenum* f. *amazonense*).

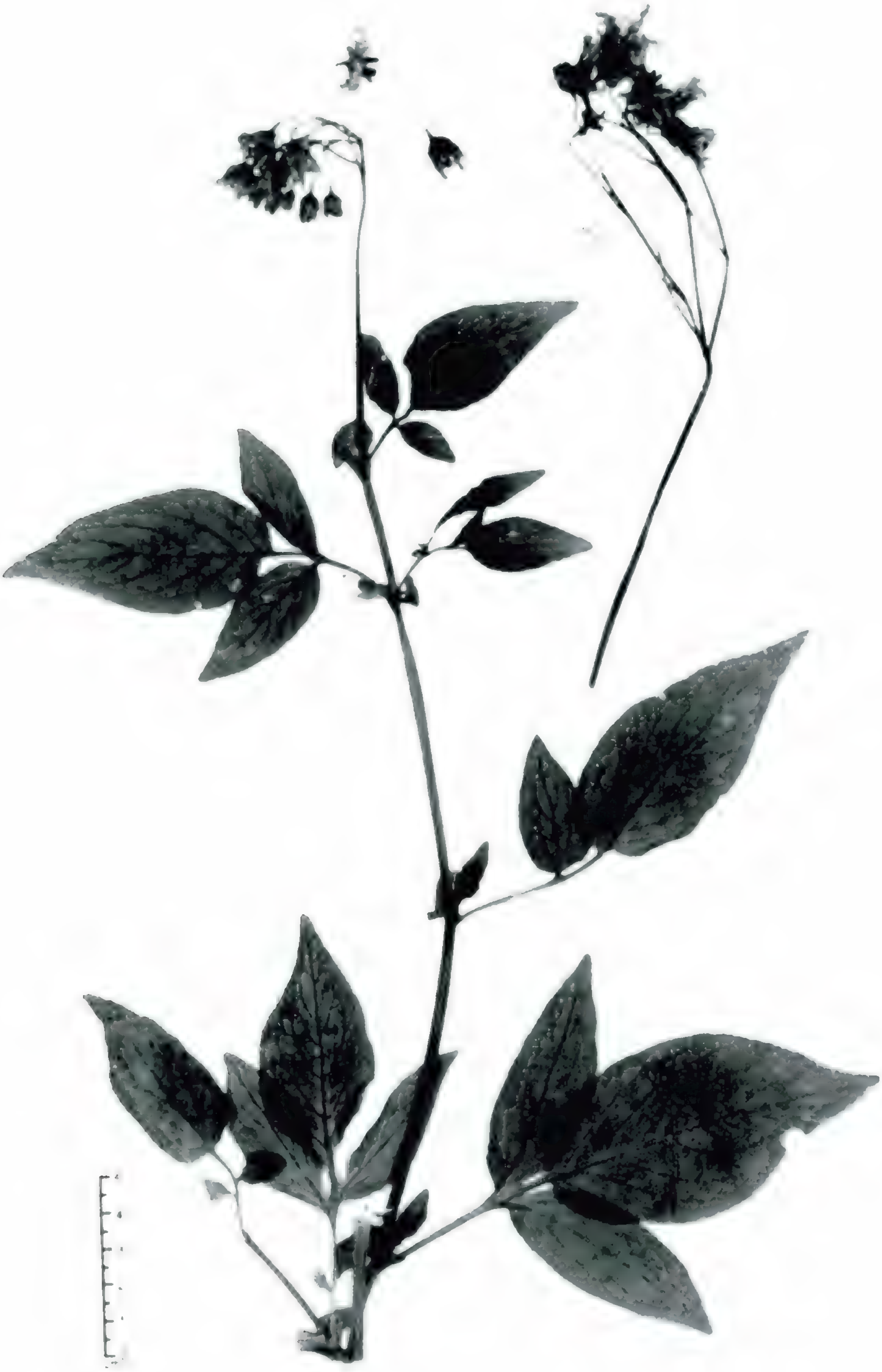


Figure 183. *Solanum chiquidenum* f. *amazonense* (*Ochoa 2673*, holotype).

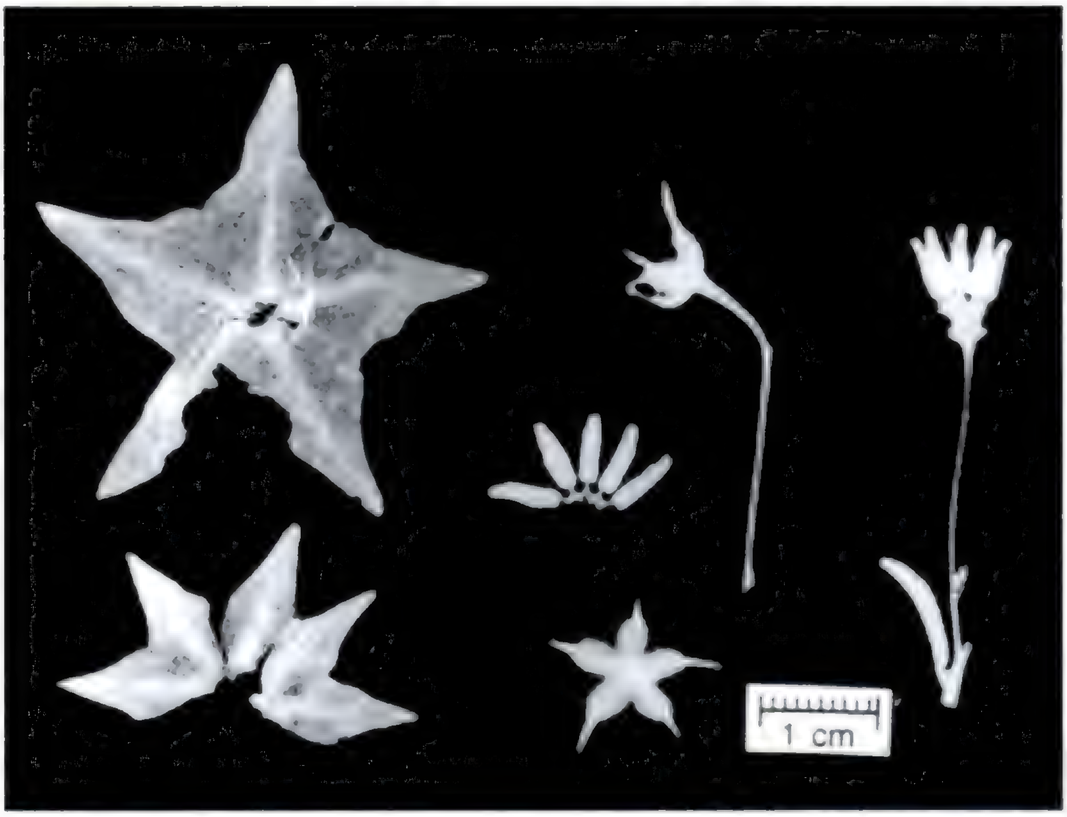


Figure 184. Floral dissection of *Solanum chiquidenum* f. *amazonense* (*Ochoa 2673*).

37. *Solanum humectophilum* Ochoa, Darwiniana 15(3-4):550-553, illustr., 1969.

Figs. 185-189; Map 15.

Plant erect, small, 30-40(-50) cm tall, glabrous or subglabrous. Stem usually simple, cylindrical wingless, slender, 3-5 mm in dia. at base, internodes 2-6 cm long. Plant stoloniferous and tuber-bearing; stolons short, 10-20 cm long; tubers round to ovoid or elongate subcylindrical, small, 1.0-2.5 cm long, moniliform (Fig. 186). Leaves imparipinnate, (9.0-) 12.5-14.0(-20.0) cm long by (7.5-)9.0-11.0(-12.0) cm broad, with 2-3 pairs of leaflets and (0-)2-3 pairs of small interjected leaflets (Fig. 186); petioles short, 6-8 mm long. Leaflets sparsely pubescent above, glabrous or subglabrous below; terminal leaflet slightly larger than the adjacent laterals, long elliptic-lanceolate or narrowly lanceolate, apex acuminate, base broadly rounded; lateral leaflets narrowly lanceolate, apex acuminate, base obliquely rounded, on 1-3 mm-long petiolules. Pseudostipular leaves broadly falcate, 7-10 mm long by 4-6 mm broad, apex pointed. Inflorescence lateral and pseudoterminal, cymose-paniculate (Fig. 188), 10-20(-25)-flowered. Peduncle short, 1-4 cm long, slender, glabrescent or glabrous; pedicels glabrous like the calyx, slender, 15-25 mm long, articulated about 7 mm below the calyx. Calyx symmetrical, 5 mm long, lobes elliptic-lanceolate to ovate-lanceolate, apex apiculate, margins strigose. Corolla rotate to rotate-pentagonal with very short lobes, pale-lilac with a bright purple internal star, 2.5-3.0 cm in dia., acumens cucullate, very prominent, with sparsely pilose margins (Figs. 186-187). Anthers lanceolate, 5.5-6.0 mm long; filaments short and thick, less than 1 mm long, lilac, pubescent externally. Style 11 mm long, exerted 2 mm, densely papillose on the lower two-thirds of its length, tinted violet; stigma capitate, small, slightly enlarged at the apex of the style. Fruit ovoid, light green, 1.5-1.8 cm long. Chromosome Number: 2n=24. EBN=1.

Local Names: *Papa del Macho* at Chanchillo and Levanto or *Papa del Gentil* at Chachacomo, both located in the Province of Chachapoyas, Amazonas.

Type: PERU. Department Amazonas, Province Chachapoyas, District Leimebamba, Chachacomo, 2875 m alt., along the margins of forests of trees and shrubs,15 May 1967, *C. Ochoa 2668* (holotype OCH, isotypes GH, MOL, US).

Habitat and Distribution

This species commonly grows in moist forests and shrub thickets in soil rich in humus. At Chachacomo, it is associated with *Weinmania*, *Escallonia*, *Barnadesia*, *Chusquea*, *Fuchsia*, *Calceolaria*, *Ranunculus*, *Verbena*, and various composites, ferns and grasses.

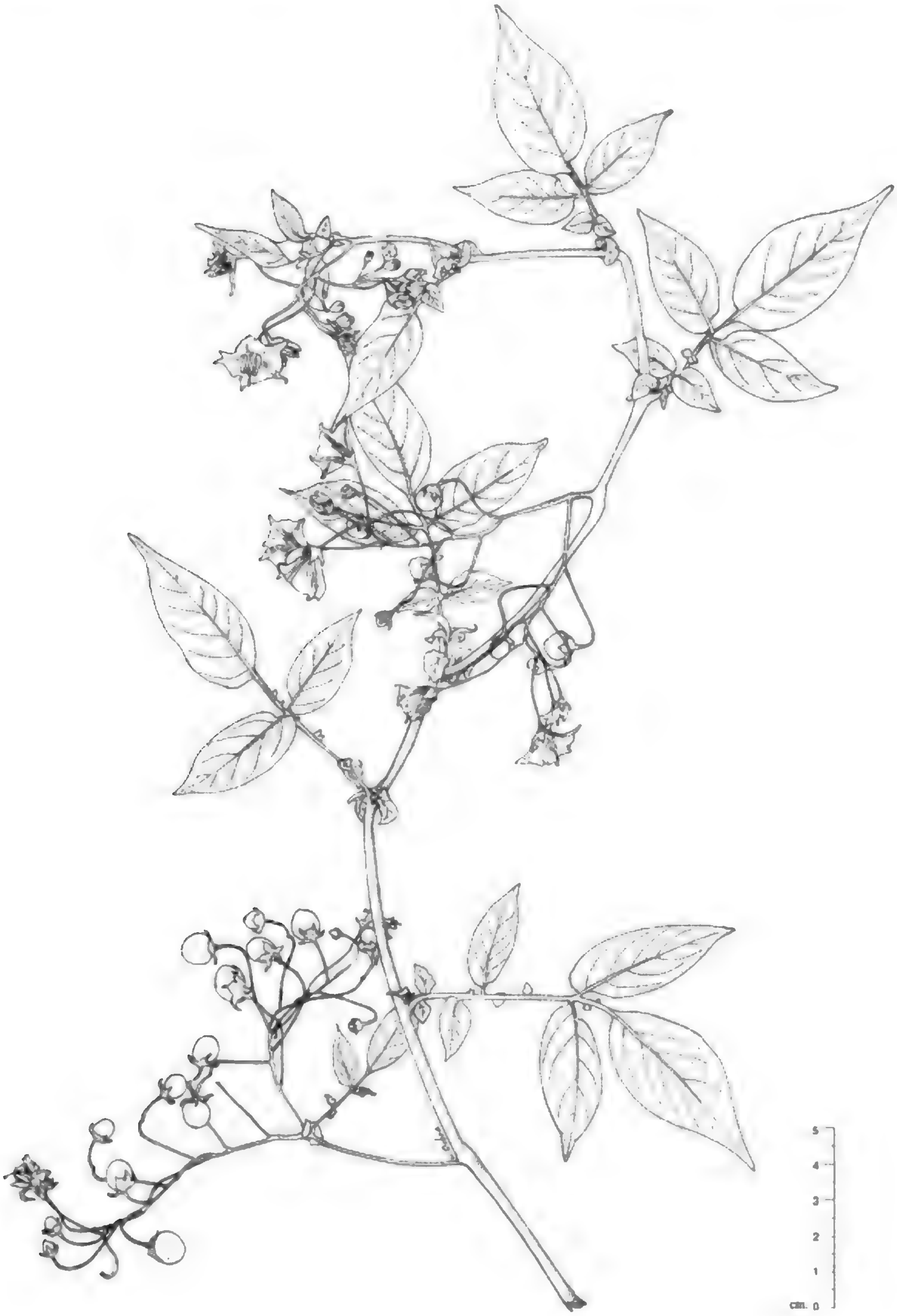


Figure 185. *Solanum humectophilum* (*Ochoa 2668*, holotype).

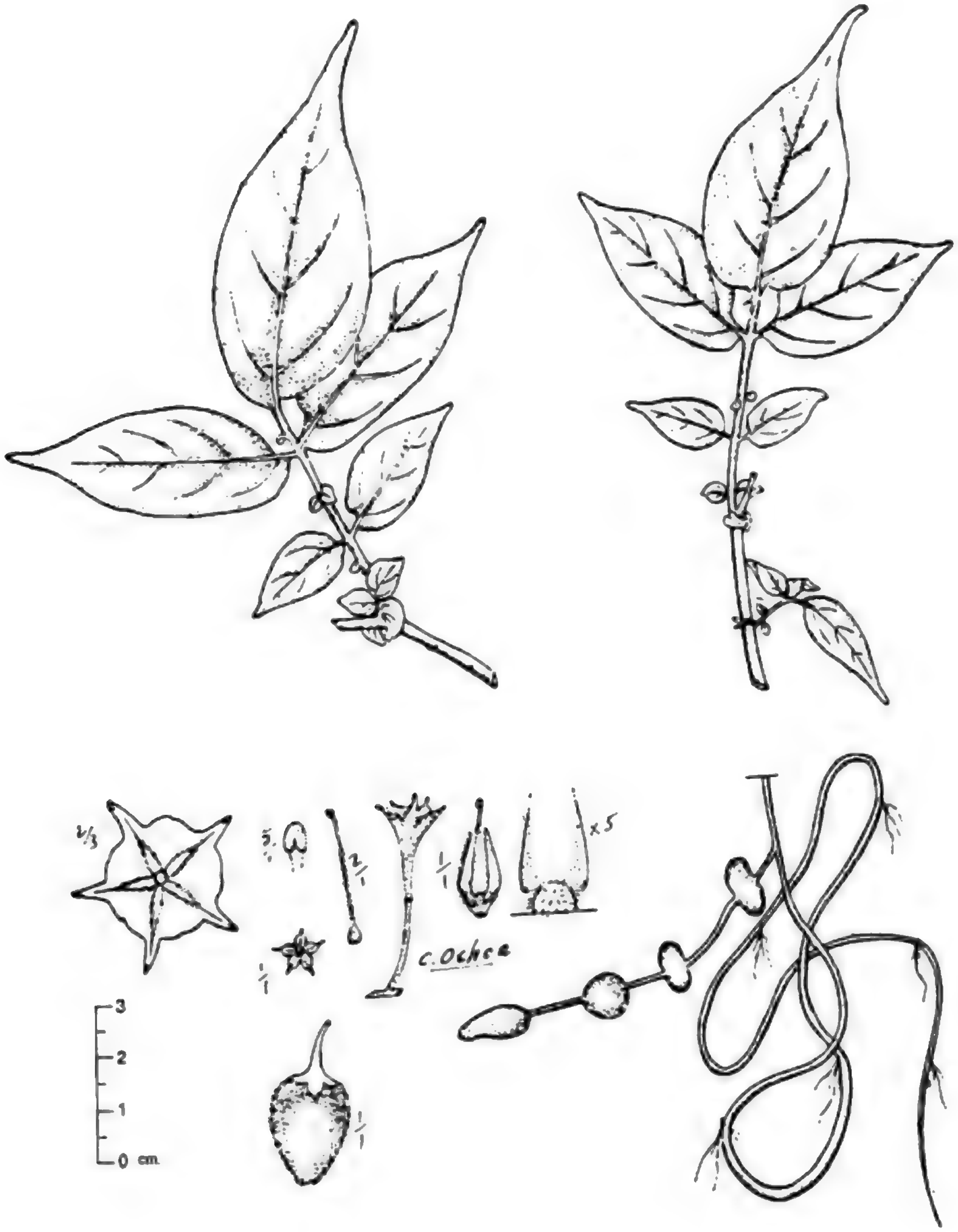


Figure 186. Leaves, floral parts, fruit, tubers and stolons of *Solanum humectophilum* (*Ochoa 2668*, holotype).

Presently, this species is known only from the Province of Chachapoyas in the Department of Amazonas, Peru.

Specimens Examined

Department Amazonas

Province Chachapoyas: Vicinity of Leimebamba, 2900 m alt., among scrub and herbs, 4 April 1963, *C. Ochoa 2475* (MOL, OCH). About 6 km southeast of Leimebamba, 2850-3000 m alt., 5 April 1963, *C. Ochoa 2478* (CIP, MOL, OCH, US). Near Lluy, 2800 m alt., along the bridle trail from Lluy to Leimebamba, along the edges of forest trees, 5 April 1963, C. *Ochoa 2479*, 2n=24 (OCH) and *2479a* (CIP, OCH, from a plant grown in the greenhouse at the Universidad Nacional Agraria La Molina, near Lima). About 3 km east of Lluy, 3200 m alt., in the foothills of the mountain with shrub and herb vegetation or in mountain clearings, in very moist black humus, 5 April 1963, C. *Ochoa 2480* (CIP, MOL, OCH, US). Llactapampa, 3000 m alt., near Leimebamba, in moist shrubby hillsides, 6 April 1963, C. *Ochoa 2482*, 2n=24 (CIP, MOL, OCH, US) and *2483* (OCH, US). Chachacomo, 2875 m alt., along the Leimebamba road to the Calla-Calla Pass, at the edge of moist forests of *Weinmania* and *Escallonia* or among scrub of *Barnadesia*, *Chusquea and Fuchsia* and herb vegetation of *Calceolaria*, *Ranunculus* and *Verbena* and various composites, ferns and grasses, 15 May 1967, C. *Ochoa 2668* (GH, MOL, OCH, US, type collection of *S. humectophilum*).

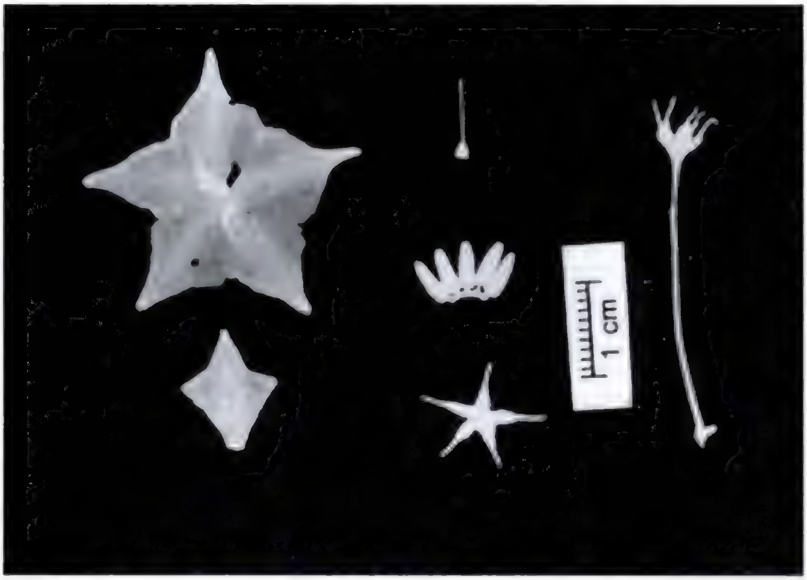


Figure 187. Floral dissection of *Solanum humectophilum* (*Ochoa 11753*).

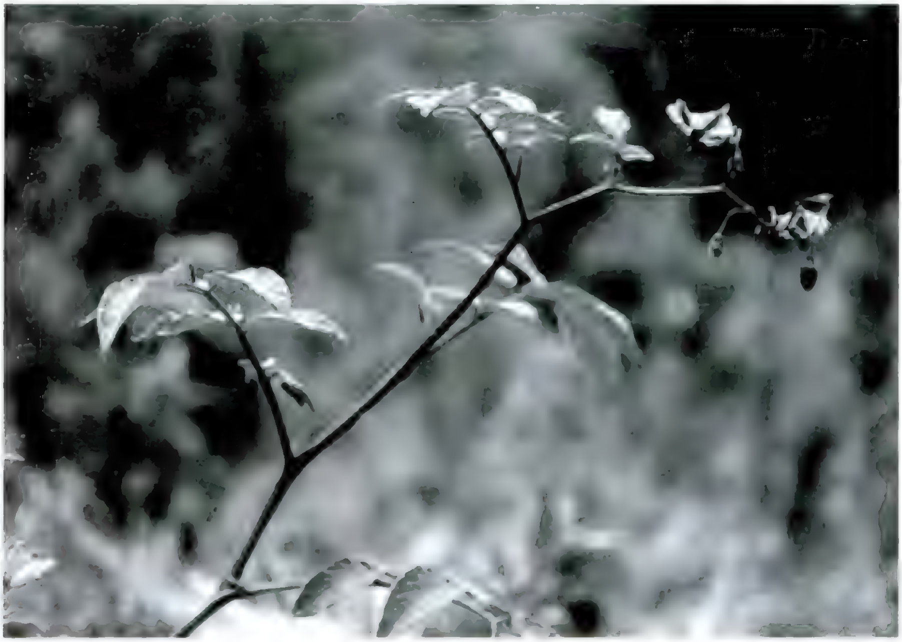


Figure 188. Inflorescence of a plant of *Solanum humectophilum* growing in its natural habitat.

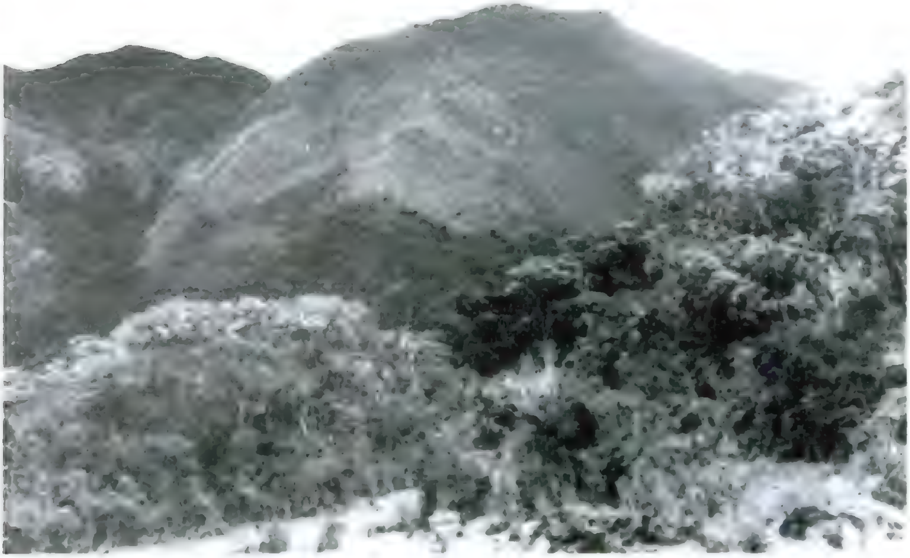


Figure 189. Habitat of *Solanum humectophilum*.

Chanchillo, 2750 m alt., between Balsas and the Calla-Calla Pass, on talus slopes among shrubs and trees in very organically rich soil, 15 May 1967, *C. Ochoa 2672* (OCH). Convento, ca. 2900 m alt., near Mayno, 16 November 1974, *Z. Maycelo s.n.* (OCH). Convento, ca. 3000 m alt., near Mayno, 25 March 1977, *Z. Maycelo s.n.* (OCH). Solmal, ca. 3000 m alt., near Levanto, 25 March 1977, *Z. Maycelo s.n.* (MOL, OCH, from plants grown in the experimental fields at Huancayo). Between Chontapampa and Cutra-Cuello, 2800 m alt., Distr. Pueblo de María, near forest trees and shrubs, 31 March 1979, *Z. Maycelo s.n.* (OCH). Convento, 2800 m alt., near Mayno, n.v. *Papa del Macho*, 31 March 1979, *Z. Maycelo s.n.* (OCH). Encañada, 2800-2900 m alt., between Leimebamba and Atuén, n.v. *Papa del Gentil*, beginning to flower, 31 March 1979, *Z. Maycelo s.n.* (OCH).

Table 49. Fertility of *Solanum humectophilum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	LIGNICAULIA	× *S. lignicaule*	5	0	0
24	2	CONICIBACCATA	× *S. chomatophilum*	15(243)	7(177)	43(77)
			× *S. rhombilanceolatum*	3(5)	2(5)	0(0)
24	2	TUBEROSA	× *S. phureja*	5(8)	5(3)	0(5)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

The results of crosses of *S. humectophilum* with diploid (2n=24) species of EBN=1 and EBN=2 are given in Table 49, while the field materials used for these experiments are shown in Table 50.

Crosses of wild diploid species with the cultivated *S. phureja* are, in general, very difficult to attain. However, when they are accomplished, as in the present case, the average number of seeds per berry is always low.

Table 50. Collections (OCH) used in *Solanum humectophilum* fertility studies.

CONICIBACCATA	LIGNICAULIA
S. chomatophilum 13196, 13199, 13200 13202, 13203, 13206, 13208, 13210 13292, 13307, 13309, 13325, 13332 13341	*S. lignicaule* 11316
S. rhombilanceolatum 11869, 14406	PIURANA *S. humectophilum* 13247, 13250
	TUBEROSA *S. phureja* 15333

38. *Solanum hypacrarthrum* Bitt., Fedde Repert. Sp. Nov. 11:367-368, 1912; Repert. Sp. Nov. 12:151, 1913.

Figs. 190-192; Map 16; Plate XVIII.

S. tuberosum var. *puberulum* Hook. f., Fl. Antartc. 2:330, 1847.

Plant erect, small, (15-)30-40(-50) cm tall. Stem simple, winged, slender, 2.5-4.0 mm in dia. at base, somewhat flexed; internodes long, (2-)4-6(-10) cm. Plant stoloniferous and tuber-bearing, stolons relatively short, 15-30 cm long; tubers small, 1.0-1.5 cm long, round to ovoid, white, occasionally moniliform. Leaves imparipinnate or rarely simple, with or without interjected leaflets (Fig. 192), rachis very narrowly winged, dark green, vernicose, glabrous or subglabrous above, light green and very sparsely pilose on the veins below with short, glandular, tetralobular hairs, sparsely pubescent near the axils of the petioles and petiolules, (9.0-)13.0-20.0(-24.5) cm long by (5.0-)6.5-11.0(-14.0) cm broad, with (0-)1-2(-3) pairs of leaflets, petioles usually long, (1-)2-4 cm. Leaflets, especially the terminal, occasionally slightly wavy-crenulate; terminal leaflet much larger than the laterals, (4.5-)7.0-14.0(-17.5) cm long by (3.5-)4.5-11.0(-14.0) cm broad, broadly elliptic to suborbicular, abruptly and shortly acuminate at apex, broadly rounded to subcordate at base and somewhat decurrent; lateral leaflets broadly ovate to ovate-elliptic or elliptic-lanceolate, pointed at apex, sessile at base, very small in relation to the terminal leaflet; the first pair of lateral leaflets (0.5-)1.5-5.0(-7.0) cm long by (0.3-)1.0-3.0(-4.0) cm broad, basiscopically decurrent. Pseudostipular leaves semiovate-cordate to obliquely lanceolate, falcate, 1.0-1.5 cm long by 0.4-0.5 cm broad. Inflorescence cymose-paniculate, 6-14(-20)-flowered. Peduncle slender, short, 2-4(-6) cm long; pedicels long, 20-30(-40) mm, slender, less than1 mm in dia.; articulated 2-3 mm below the calyx. Calyx sym-

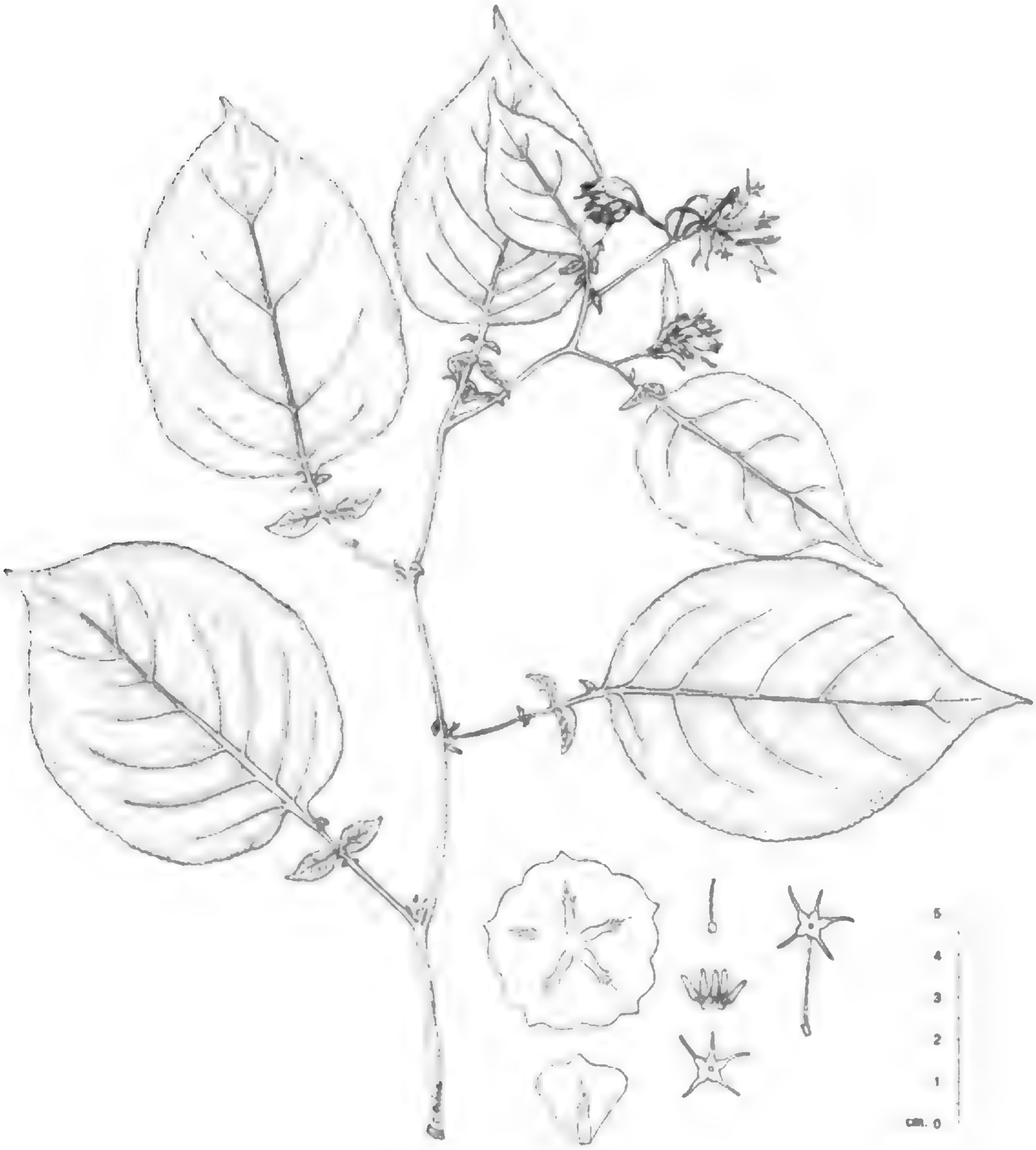


Figure 190. *Solanum hypacrarthrum* (*Ochoa 7423*).

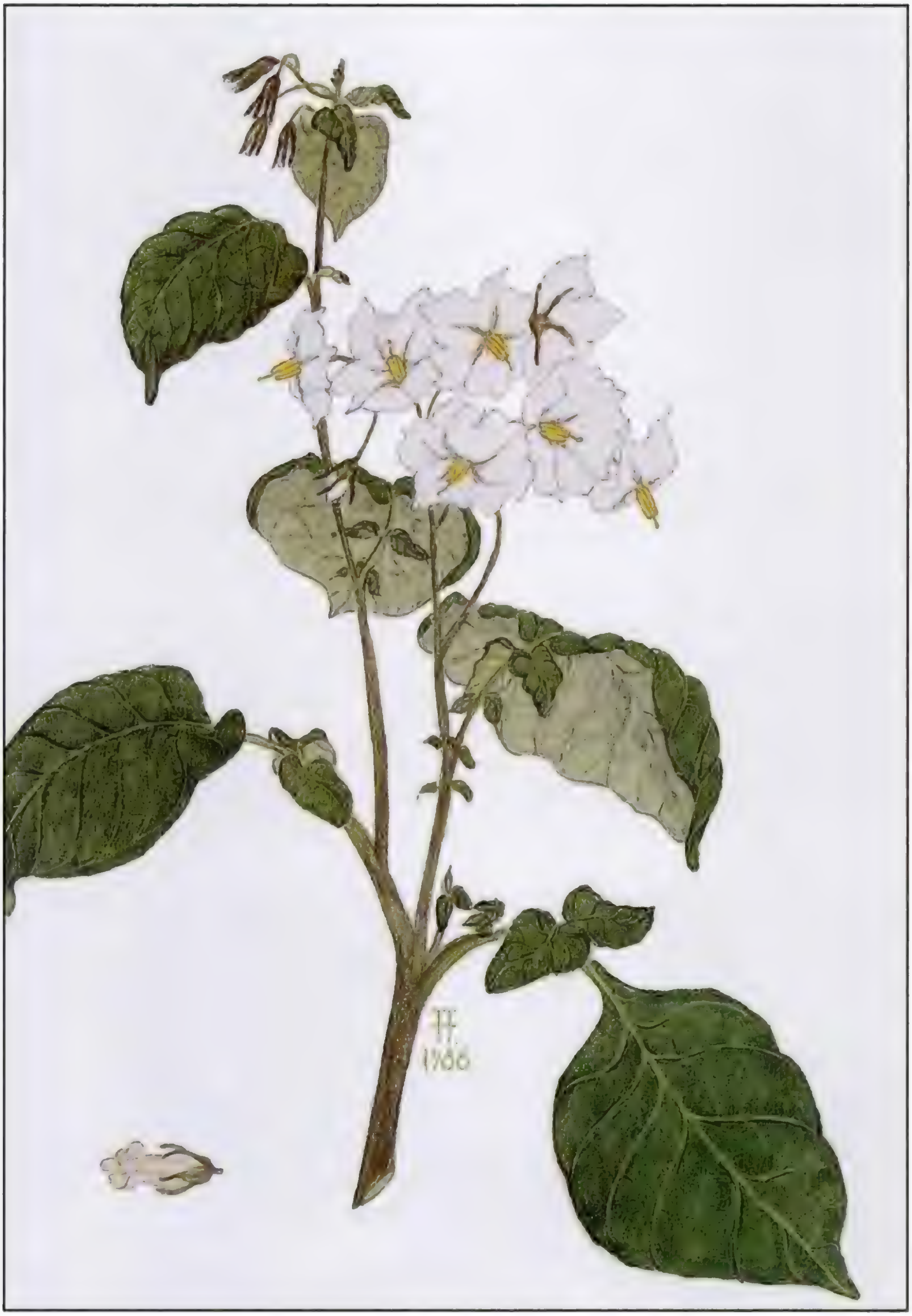


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Plate XVIII. *Solanum hypacrarthrum* Bitt.

metrical, 10-12(-15) mm long, very sparsely pilose; lobes ovate-lanceolate unequally long with long acuminate apex (Fig. 191); acumens 4-8 mm long, narrowed and pointed or rarely subspatulate. Corolla rotate, white, large and showy (Fig. 191), 3.5-4.0 cm in dia. Anthers narrowly lanceolate, pale yellow, 5.5-6.5 mm long; filaments 1.0-1.5 mm long, white-hyaline, glabrous. Style 11 mm long, very slender, densely papillose along the lower two-thirds of its length; stigma claviform, small. Fruit small, 1.0-1.5 cm in dia., subellipsoid to pyriform, grayish-green at base, light green, sparsely flecked with small white dots above (not verrucose). Chromosome Number: 2n=24. EBN=1.

Local name: *Papa de Gentil* at Arahuay and Huamantanga, Province Canta, Lima.

Type: PERU. Department Lima, Province Canta, Cuesta de Puruchuca [Puruchuco], April 1832, *A. Mathews* 772 *p.p.* (holotype BREM, isotypes CGE, E, GL, K, L, OXF).

At the time when Bitter made his original diagnosis of *S. hypacrarthrum*, he was not aware of the geographic source of his type specimen, since it was lacking in locality data and labeled previously in the Bremen Herbarium as simply "*S. tuberosum* L.?" Moreover, the name of the collector was not specified in Bitter's original diagnosis. However, not long after Bitter clarified this matter in the Fedde Repert. Sp. Nov. 12:151, 1913, as follows: *Das Exemplar im Bremer Herbar, nach welchem meine Originaldiagnose in Fedde, Rep. XI. 367 verfasst ist, gehort offenbar ebenballs zu Mathews no. 772, so dass nunmehr die mir bisher unbekannte*

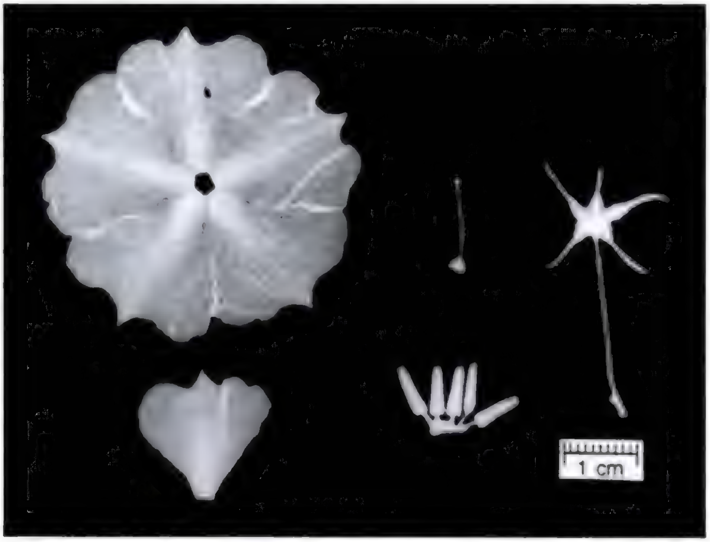


Figure 191. Floral dissection of *Solanum hypacrarthrum* (*Ochoa* 13272).

engere Heimat dieser interessanten Spezies nachgetragen werden kann." Thus, Bitter identifies his type collection as *Mathews 772* (holotype, in the modern concept, Art. 9.1 of the ICBN, Tokyo Code 1994). A bit further on in the same article he reveals the specimen came originally from the Cuesta de Puruchuca [Puruchuco], situated northeast of Lima, in the Province of Canta.

To make matters worse, the material of *Mathews* 772 at the CGE Herbarium consists of two specimens that appear to have been fairly recently remounted on a single sheet. During the course of the repair work a mix-up in labeling occurred. The plant labeled No. 1 on this sheet is indeed the *Mathews* 772 collection of *S. hypacrarthrum*; whereas the plant which has been marked No. 2 on this same sheet is that of *S. tuberosum* subsp. *andigena*. It is very unlikely, however, that the latter cultivated species was collected on the very steep and arid slopes of the Cuesta de Puruchuco.

Affinities

As the leaves of this species, among other characteristics, are very distinctive, it is not easily confused with other tuber-bearing species. Its closest relative appears to be *S. medians*, to which it appears to be related by its campanulate and densely pilose calyx and narrowly lanceolate and very long acumens. This species is also similar to *S. medians* in having a very enlarged terminal leaflet, but in this case the terminal leaflet is always much larger than the laterals and the apex is conspicuously acuminate.

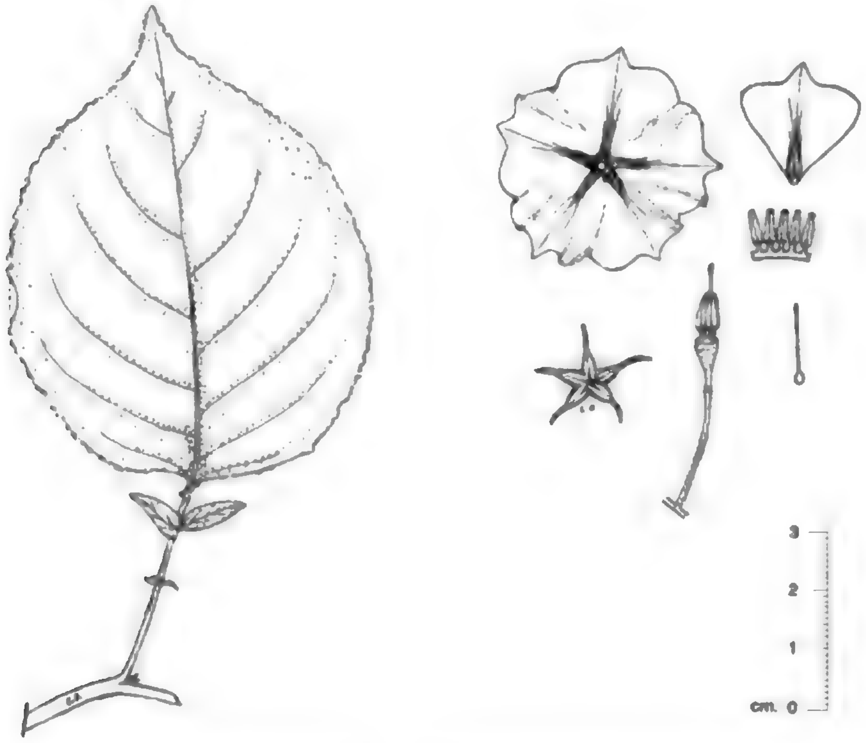


Figure 192. Leaf and floral dissection of *Solanum hypacrarthrum* (*Ochoa 2049*).

Habitat and Distribution

This species lives preferentially on stony and rocky slopes and in dry quebradas with columnar and prickly-pear cacti such *as Neoraimondia macrostibas* and *Opuntia exaltata*, shrubs such as *Mito* (=*Carica candicans*), *Eupatorium* and *Lupinus*, and herbs and vines such as *Oxalis* and *Sicyos*. It often grows in sandy-clay soil or among rocks, where it may be associated with *S. medians* and *S. wittmackii*.

Solanum hypacrathrum is distributed in the mountains of the eastern side of the central Andes in the Departments of Lima and Ancash, at elevations between 2000 and 3400 m. Only exceptionally has it been collected at altitudes to 3800 m in San Pedro de Casta, Province Huarochirí, Lima or at altitudes ranging down to 1000 m, such as in the hill formations of Huaro, between Playa Grande and Casma, on the north coast in the Department of Ancash.

The northern limits of this species occur in the vicinity of Aldave, Province Aija (09°52' S and 77°41' W); and in the south at Cuesta de Puruchuco (11°31' S and 76°44' W).

Specimens Examined

Department Ancash

Province Aija: Yuncapampa, 2000 m alt., between Aguada Monsalve and Ushpacoto, heading up from San Miguel by railroad toward Huayán, among large rocks and the columnar cactus *Neoraimondia* sp., April 1971, *C. Ochoa 2967* (OCH). Ushpacoto, 2200 m alt., between Yuncapampa and Ccotup, heading up the railroad line from San Miguel to Huayán, April 1971, *C. Ochoa 2969* (OCH). Near Aldave, 2350 m alt., heading up the railroad line from San Miguel to Huayán, in stony soils among shrubs of *Mito*, April 1971, *C. Ochoa 2970* (OCH). Llusupuquio, 2800 m alt., near Tullupectu, along the railroad from Huayán toward Malvas, abundant, among *Oxalis* sp., tubers small, 1 cm in dia., white-violet submoniliform, 20 June 1977, *C. Ochoa 11692*, 2n=24 (CIP, OCH, US, from plants propagated by tuber in the field at Huancayo) and (OCH, from plants reproduced in the greenhouse at Huancayo). Above Aldave, 2800 m alt., on the bridle trail from Huayán to San Miguel, 24 April 1983, *C. Ochoa 15180* (CIP, OCH) and *15181*, 2n=24 (CIP, MOL, OCH, US).

Province Casma: Hills of El Huaro, 1000 m alt., about 4 km west of km 356 on the northern Panamerican Highway, between Playa Grande and Casma, just on the western side of Cerro Huaro, among large rocks, scarce, flowers white, 23 October 1982, *C. Ochoa* and *A. Salas 14861*, 2n=24 (OCH).

Province Huaraz: Highlands between Huanchay and Pampas, 3400 m alt., 7 June 1983, *C. Ochoa and J. Espejo 15254* (OCH). Quillpacc, 2750 m alt., about 2 km north-northeast of Huanchay, amid scrub and herbs in stony soils, 4 May 1984, *C. Ochoa, A. Salas and J. Espejo 15740* (CIP, GH, MOL, OCH, US).

Department Lima

Province Canta: Cuesta de Puruchuca [Puruchuco], April 1832, *A. Mathews 772 p.p.* (BREM, CGE, E, GL, K, L, OXF, type collection, *fide* Bitter). Only the CGE *Mathews 772* sheet has 2 plants: plant 1 = *Solanum hypacrarthrum* and plant 2 = *S. tuberosum* subsp. *andigena* [both mounted much later than the original Mathews collections]. Cuesta de Huamantanga, 3400 m alt., heading up toward the town of Huamantanga via the Shuyo [today Nuevo San José] road, on stony mountain slopes, 30 March 1953, *C. Ochoa 2049* (OCH, US). Huarimayo, 2600 m alt., heading up to Huamantanga via the detour on the Lima-Canta road, in poor stony ground among cacti, April 1964, *C. Ochoa 2575* (OCH). Cuesta de Huamantanga, between Boquellón and Pauchocha, 3100 m alt., heading up from Huarimayo to Huamantanga, 21 March 1971, *C. Ochoa 2961* (OCH). Arahuay (Pallashcushco), 3000-3100 m alt., in the foothills of the mountain, between stone walls, under shrubs in cultivated land, flowers white, berries spherical, green, n.v. *Papa de Gentil*, 28 March 1974, *G. Vilcapoma 206-1* (CIP, GH, MOL, OCH, US), *206-2* (CIP, GH, OCH, US), *206-3* (CIP, OCH) and *206-4* (CIP, OCH, US). Viscas (Apio), 2700 m alt., May 1974, *G. Vilcapoma 225-1* (CIP, OCH), *225-2* (OCH), *225-3* (CIP, OCH) and *225-4* (OCH). Huamantanga, 3200 m alt., herb with white flowers, in stony ground, fruits light green speckled with white dots, 8 May 1974, *G. Vilcapoma 228* (CIP, OCH). Cuesta de Huamantanga, 2900 m alt., heading up from Huarimayo, n.v. *Papa de Gentil*, 11 March 1977, *C. Ochoa 11308* (CIP, OCH). Distr. Lachaqui, Huallincocha, 3200 m alt., April 1978, *C. Ochoa and A. Salas 12524* (CIP, MOL, OCH, USM). Along the footpath from Antura, near Arahuay, toward the pre-Inca ruins of Huarhuaymarca, between 2550 and 2900 m alt., associated with *Solanum* × *arahuayum*, 6 April 1979, *C. Ochoa 13260*, 2n=24 (OCH). Cuesta de Huamantanga, 3000 m alt., between San José and Huamantanga, berries round to pyriform, small, 10 mm in dia., light green speckled with many white dots, tubers white scarcely 8-10 mm, round to oval-flattened, 12 April 1982, *C. Ochoa 14715* (CIP, OCH, US).

Province Huarochirí: Between Huaquicha and Llacllisi, 2600-2800 m alt., above Surco, in moist ground with *Calceolaria*, flowers white, 1 May 1948, *R. Ferreyra 3413* (USM). Near Huaquicha and Llacllisi, 1800 m alt., east of Surco, among *Lupinus*, *Calceolaria* and abundant *Sicyos*, flowers white, very few fruits, tubers pale mauve, 27 March 1951, *C. Ochoa 1163* (GH, OCH, US) and *1165* (OCH). In forest shrubs near San Bartolomé, Zárate, *ca.* 3000 m alt., tubers small, 28 May 1959, *L. Diers 1128* (MAX). Huaquicha, 1800-2000 m alt., heading up by foot east of Surco, amid herbaceous vegetation, 6 April 1960, C. *Ochoa 2291* (CIP, GH, MOL, OCH, US). Huinco (San Pedro de Casta), ca. 3000 m alt., amid lush vegetation, 22 April 1972, *Z. Huamán 307* (CIP, OCH). About 1 km above San Pedro de Casta, ca. 3800 m alt., among many weeds, 22 April 1972, *Z. Huamán 308* (CIP, OCH) and *309* (CIP, OCH). Heading up by foot from San Bartolomé toward the forest of Zárate, 2700 m alt., on stony talus slopes, near Zárate, March 1975, C. *Ochoa 7417* (OCH). Pachacosa, ca. 3650 m alt., March 1975, C. *Ochoa 7422* (CIP, OCH). Above Huaquicha, 3000 m alt., east of Surco, 2800-3000 m alt., in sandy-clay soil beneath rocks, tubers small, March 1975, C. *Ochoa 7423* (OCH). Heading up from Langa toward Lanchi, 2900 m alt., on the Lima-Huarochirí road vía Sisicaya, on stony and very dry talus slopes, March 1975, C. *Ochoa 7428* (OCH). Gigantón, 2900 m alt., heading up from San Bartolomé toward the forest of Zárate, n.v. *Papa de Gentil*, 16 March 1977, C. *Ochoa 11313* (OCH). Above Autisha, 2575 m alt., heading up toward Huinco, Quebrada de Santa Eulalia, in the stony foothills, growing near *S. medians* and *S. wittmackii*, 11 April 1979, C. *Ochoa 13272*, 2n=24 (CIP, GH, MOL, OCH, US) and (OCH, from plants reproduced from tubers in the greenhouse at Huancayo). Between Langa and Matarachi, 2000 m alt., on the Lima-Huarochirí road vía Sisicaya, beginning to flower, March 1982, C. *Ochoa 14608*, 2n=24 (CIP, OCH). Huaquicha, 2600 m alt., *ca.* Surco, tubers small, 5-10 mm in dia., berries very small, 8-10 mm in dia., scarce, 21 April 1982, C. *Ochoa 14727*, 2n=24 (CIP, OCH) and (OCH, from plants reproduced in the greenhouse at Huancayo). Heading down from Chinchina to Lucumani, 2800 m alt., on the Chinchina-Lucumani road, Distr. Santiago de Tuna, 21 April 1982, C. *Ochoa 14729* (OCH). Left bank of the Huaricancha River, 2300 m alt., above the water intake of Lucumani, Distr. Santiago de Tuna, 21 April 1982, C. *Ochoa 14731*, 2n=24 (CIP, OCH, US) and (OCH, from plants reproduced in the greenhouse at Huancayo). Talus slopes along the Huachupampa-Iris road, 3000 m alt., growing near *S. multiinterruptum*, flowers white, 30 March 1994, *Luis Masson Meis s.n.* (OCH).

Natural Hybrid of *Solanum hypacrarthrum* × *S. medians*?

By the characterístics of its leaves and light blue-lilac corolla, and especially of its terminal leaflet, which is very similar to *S. hypacrarthrum*, the following specimen appears to be a natural hybrid of *S. hypacrarthrum*, possibly with a diploid form of *S. medians*.

Department Ancash

Province Bolognesi: Piedraliza, 3570 m alt., Chilcas, in high mountains among rocks, flowers bluish-lilac, 2 May 1978, *E. Cerrate 7240* (USM).

Table 51. Fertility of *Solanum hypacrarthrum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	LIGNICAULIA	× *S. lignicaule*	5(2)	5(0)	33(0)
24	1	SIMPLICISSIMA	× *S. guzmanguense*	14(18)	0(0)	0(0)
24	1	TUBEROSA	× *S. chancayense*	6(7)	3(3)	101(0)
			× *S. immite*	11(9)	9(4)	49(7)
			× *S. mochiquense*	43(18)	16(0)	13(0)
			× *S. trinitense*	7	0	0
			× *S. wittmackii*	24(14)	16(4)	43(150)
24	2	CONICIBACCATA	× *S. chomatophilum*	15(11)	0(6)	0(0)
			× *S. contumazaense*	8	0	0
24	2	PIURANA	× *S. acroglossum*	9	0	0
			× *S. cantense*	5(6)	0(0)	0(0)
			× *S. chiquidenum*	12(14)	0(0)	0(0)
			× *S. piurae*	7	0	0
24	2	TUBEROSA	× *S.* × *arahuayum*	9	3	56
			× *S. bukasovii*	14(23)	0(16)	0(0)
			× *S. marinasense*	2/9	2(0)	0(0)
			× *S. medians var. autumnale*-2x	54(10)	18(3)	6(10)
			× *S. multiinterruptum*	19(11)	12(0)	0(0)
			× *S. tacnaense*	14(9)	13(2)	2(2)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

The results of crosses of *S. hypacrarthrum* with diploid (2n=24) species of EBN=1 and EBN=2 are given in Table 51, while the field materials used for these experiments are shown in Table 52.

With the exception of reciprocal crosses involving *S. wittmackii*, little or no success was attained in crosses between *S. hypacrarthrum* and with other species having the same EBN value. While the same was true for plants having a different EBN value than *S. hypacrarthrum*, these results fell, at least, within the realm of theoretical expectation for such experiments.

Table 52. Collections (OCH) used in *Solanum hypacrarthrum* fertility studies.

CONICIBACCATA
S. chomatophilum 13004, 13012, 13201
S. contumazaense 14751

LIGNICAULIA
S. lignicaule 11617

PIURANA
S. acroglossum 11297
S. cantense 14664, 14828
S. chiquidenum 13965A
S. hypacrarthrum 11308, 11692, 13272 14715, 14731
S. piurae 13959

SIMPLICISSIMA
S. guzmanguense 15991

TUBEROSA
S. × *arahuayum* 13257
S. bukasovii 13195, 13814, 14311, 15623
S. chancayense 11250, 11765
S. immite 11689, 13346, 14491
S. marinasense 15687
S. medians-2x 11302, 13185, 13243, 13268
S. mochiquense 14820, 14870, 15995
S. multiinterruptum 11314, 14718
S. tacnaense 11611
S. trinitense 13968
S. wittmackii 11029, 11312, 11639, 11877, 13184, 14674

39. *Solanum paucissectum* Ochoa, Agronomía, Lima, 27(4):365-366, illustr., 1960. Ochoa, *Los Solanum Tuberíferos Silvestres del Perú*, Lima, 107-109, illustr., 1962. Figs. 193-199; Map 15; Plate XIX.

Plant erect to decumbent (Fig. 193), occasionally rosette forming or subrosette forming at base (Fig. 194), (20-25-)40-60(-75) cm tall. Stem cylindrical, wingless, light green or pigmented bluish-violet, slender, 3.5-5.5(-7.0) mm in dia. at base, glabrous or subglabrous, hairs scarcely distinguishable, internodes 1.0-1.5 cm long at base in rosette forming plants, 3.0-6.0(-8.5) cm long in plants not forming a rosette. Stolons 50-70(-90) cm long, slender, less than 1.5 mm in dia.; tubers moniliform, round to ovoid, 1.0-1.5 cm in dia., white. Leaves (4.5-6.0-) 7.0-11.0(-16.0) cm long by (2.3-3.5-)4.0-7.0(-8.0) cm broad, little divided, with (0-)1-2 pairs of leaflets, simple or with 1-2 pairs of lateral leaflets, very rarely with 3 pairs of leaflets, without interjected leaflets; petioles 1.0-3.5 cm long. Leaflets elliptic-lanceolate to ovate-lanceolate or narrowly elliptic-lanceolate, glabrous and vernicose or subvernicose above, with a few short tri-tetralobular hairs on the veins below, also with few, short, glandular hairs on the rachis below. Terminal leaflet considerably larger than the laterals, (3.0-3.5-)4.5-8.0(-10.5) cm

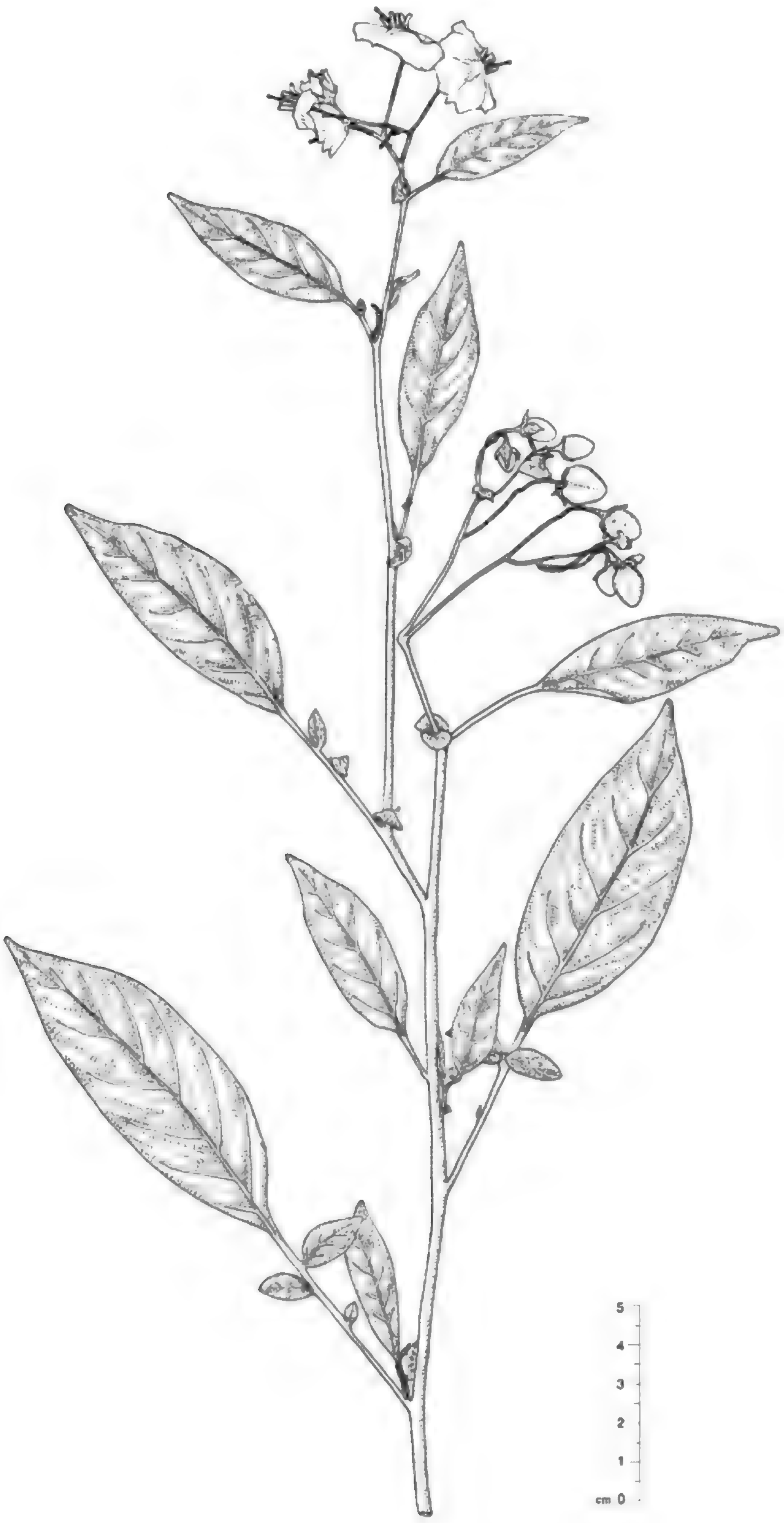


Figure 193. *Solanum paucissectum* (*Ochoa 2321*, holotype).

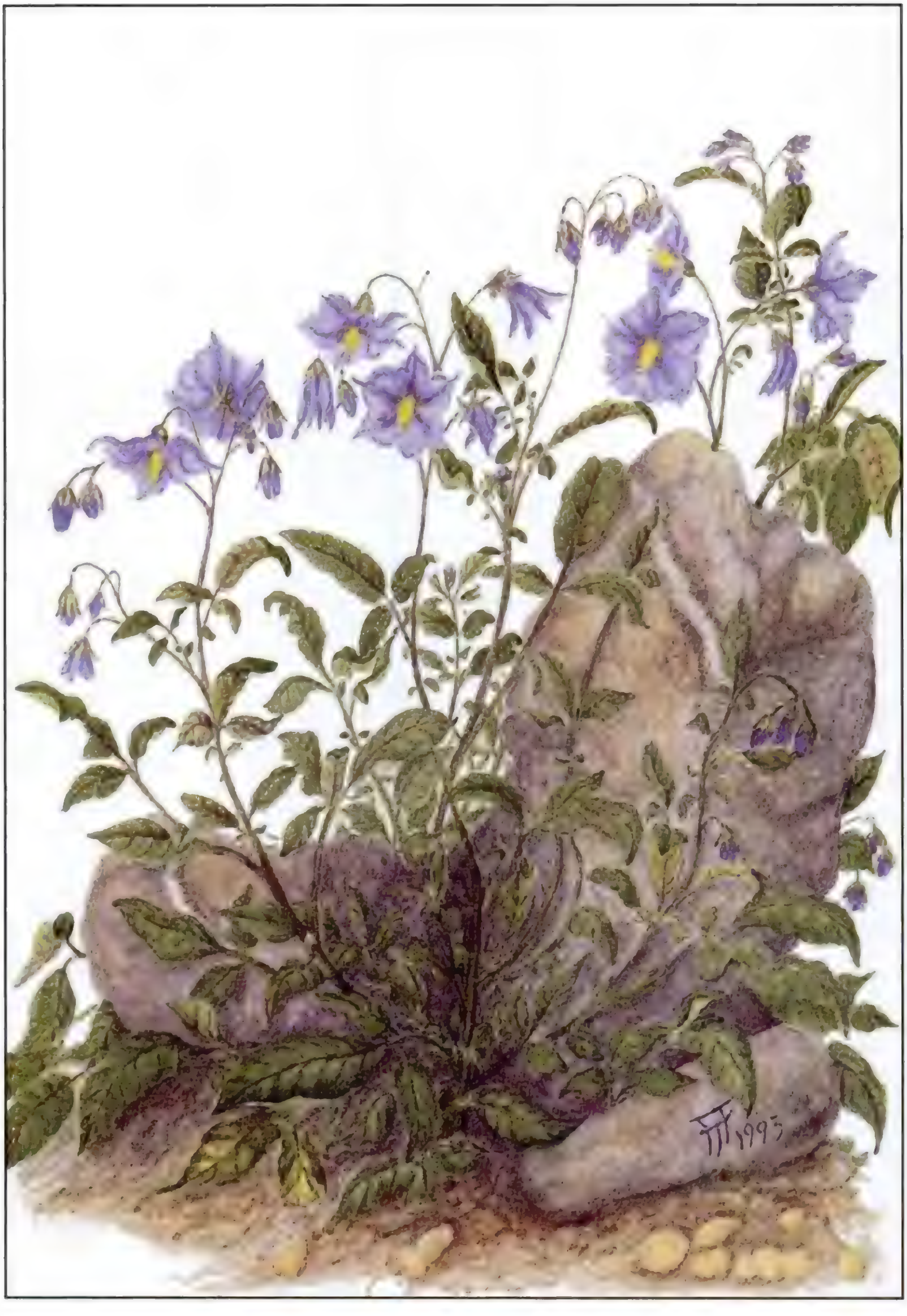


Plate XIX. *Solanum paucissectum* Ochoa.

long by (1.3-)2.0-2.5(-3.6) cm broad, apex subpointed, base rounded or cuneate, margins entire or occasionally slightly wavy, minutely ciliate or fimbriate; lateral leaflets opposite or alternate, the first upper pair (0.5)1.6-2.5(-4.0) cm long by (0.2-)1.0-2.0(-2.5) cm broad, subsessile or sessile, very narrowly decurrent about the rachis. Pseudostipular leaves narrowly falcate, usually small, (-0.7-2.0-)5.0 -7.5(-10.0) mm long by (0.3-1.0-)2.0-2.5(-3.0) mm broad. Inflorescence cymose, terminal or lateral, 3-8-flowered. Peduncles short and slender, (0.5-)3.0-4.0(-5.0) cm long by 1.0-1.5 mm in dia. at base, occasionally bracted; pedicel glabrous, (15-20-)25-30 mm long, articulated 5-7 mm below the base of the calyx. Calyx cup-shaped, 5-6 mm long, pigmented; lobes ovate-lanceolate, abruptly narrowed to the short pointed or subspatulate 2(-3) mm long acumens. Corolla rotate-pentagonal (Figs. 194, 197) or pentagonal (Fig. 195), 2.5-3.0 cm in dia., generally white but varying from whitish-lilac to light blue (white in the type collection with a light lilac star on the external side that extends from the apex of the acumen to the base of each petal); internal star pale yellowish-green to whitish-gray. Anther column cylindrical-conical, symmetrical; anthers narrowly lanceolate, 5.0(-6.5) mm long, pale yellow or lemon yellow, not cordate at base; filaments white-hyaline or greenish-white, 1.0-1.5 mm long by 0.8 mm thick. Style 10-11 mm long, exerted 3-4 mm, very slender, almost filiform, densely papillose below center; stigma subcapitate or claviform, slightly enlarged at the apex of the style, light green. Fruit long-conical (Fig. 198) or occasionally ovoid (Fig. 196), 2.5-3.0 cm long, dark green with reticulate markings or marbled darker green. Chromosome Number: 2n=24.

Type: PERU. Department Piura, Province Huancabamba, Ciénago Largo, 3180 m alt., near Piedra Bola, along the descent 39. Solanum paucissectumfrom Paso Cuello del Indio to Huancabamba, in marshes and very moist soils, 5 May 1960, *C. Ochoa 2321* (holotype OCH, isotype US).

Affinities

Some features of *S. paucissectum* are so similar to *S. acroglossum* that Correll (1962) believed this species should be treated as a synonym of the latter. However, in the opinion of the present author, there are equally strong morphological differences between these two taxa, and this justifies their separation. Thus, plants of *S. paucissectum* are usually rosette-forming, have fruits that are long-ovoid to elongate-conical, and have smaller anthers and calyces than *S. acroglossum*. Moreover, the corolla in *S. paucissectum* is more rotate than pentagonal, and varies in color from white to lilac and light blue. On the other hand, plants of *S. acroglossum* are never rosette-like and have round fruits and more broadly rotate-pentagonal,

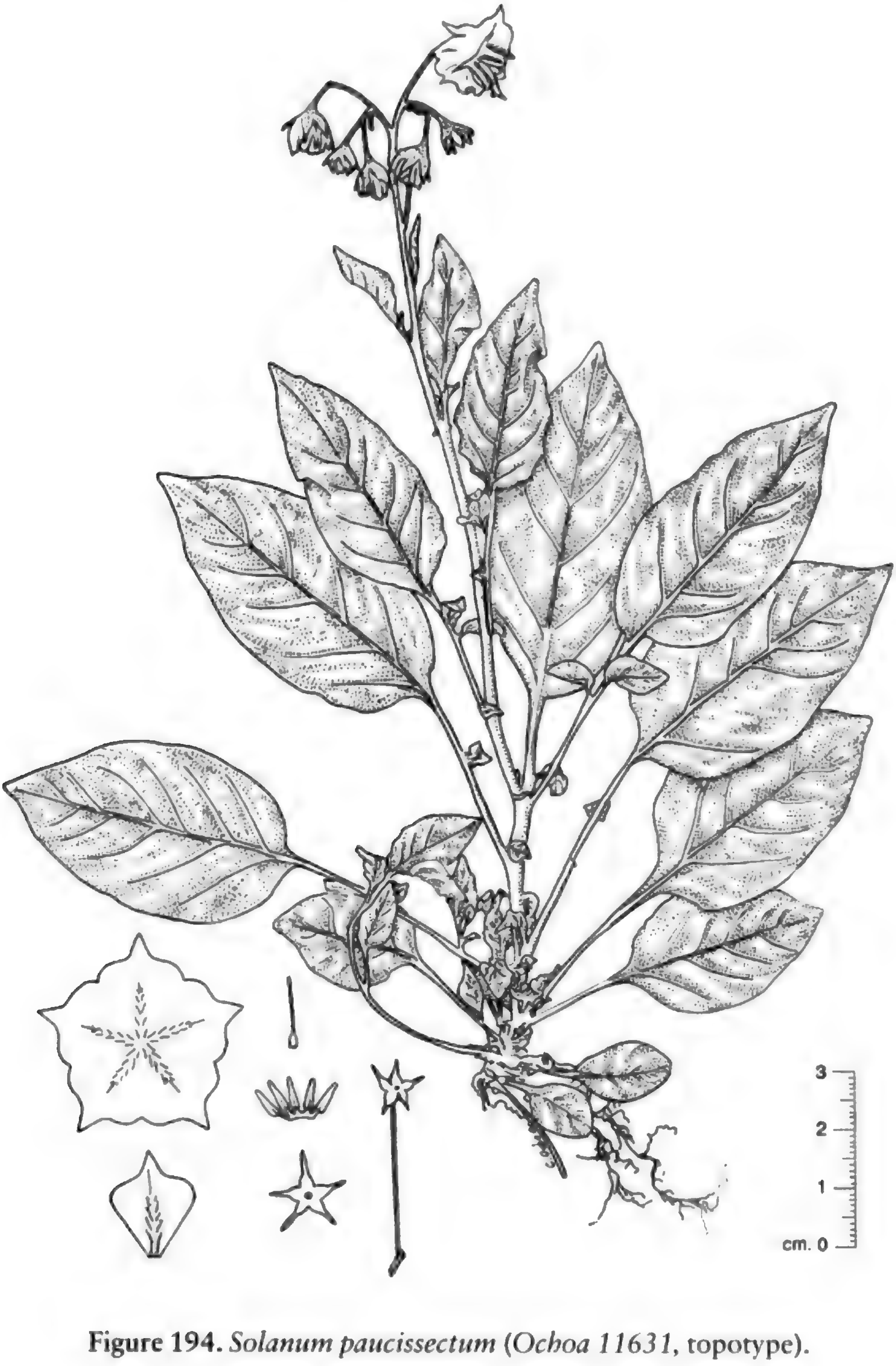


Figure 194. *Solanum paucissectum* (*Ochoa 11631*, topotype).

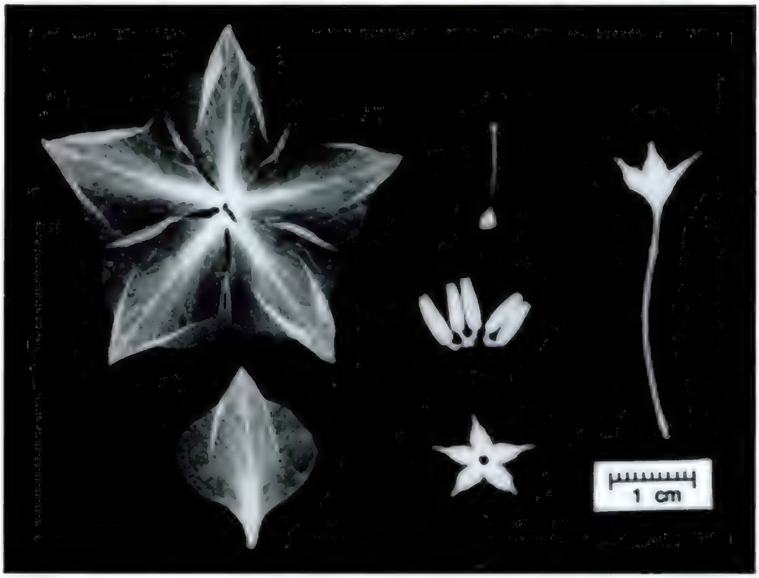


Figure 195. Floral dissection of *Solanum paucissectum* (*Ochoa 11628*).

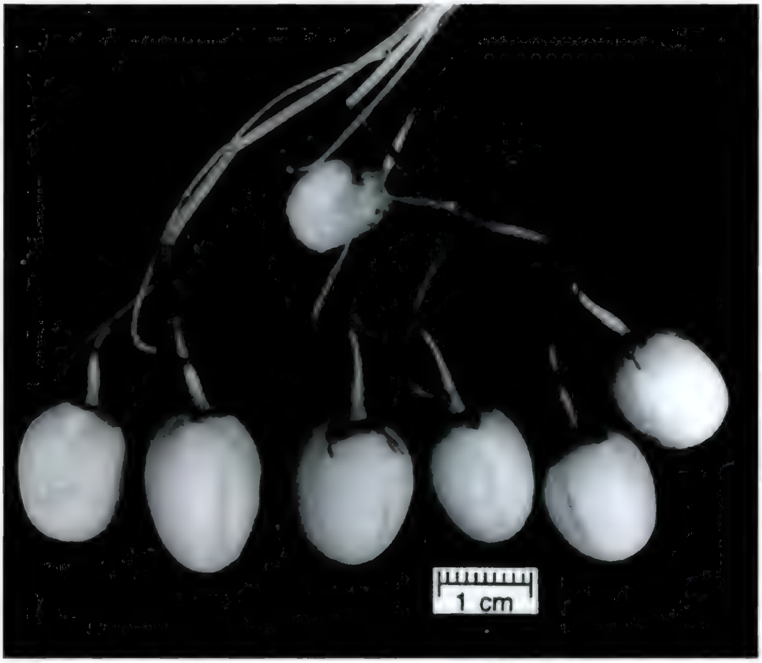


Figure 196. Fruits of *Solanum paucissectum* (*Ochoa 11628*).

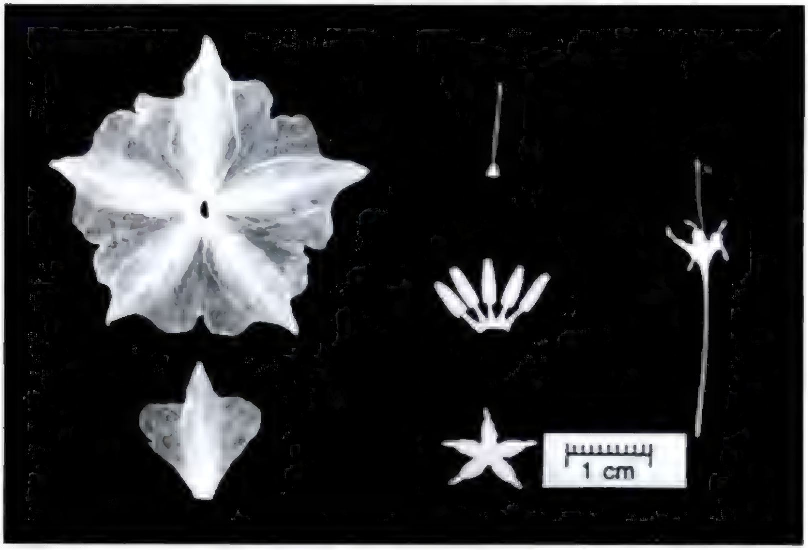


Figure 197. Floral dissection of *Solanum paucissectum* (*Ochoa 11629*).

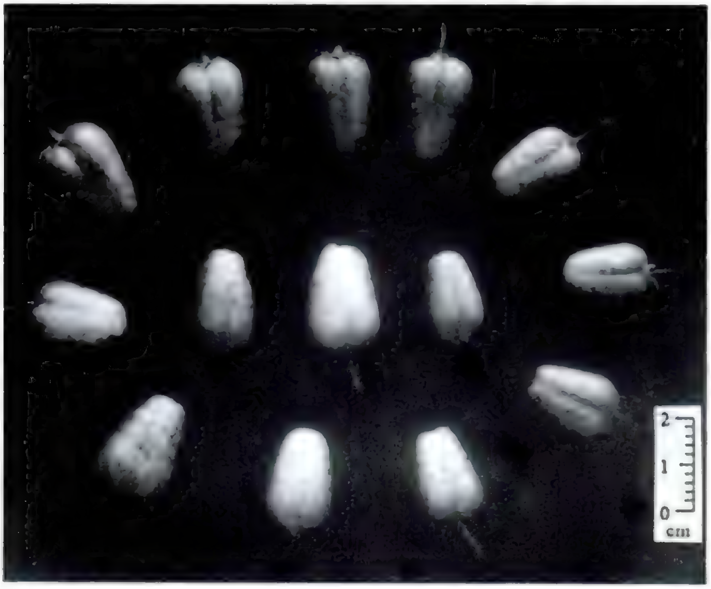


Figure 198. Fruits of *Solanum paucissectum* (*Ochoa 14816*).

blue or dark blue corollas. Similarly, there are marked differences between the two species with respect to the degree of dissection of the leaves, and, above all, with respect to the shape of their leaflets. Thus, the leaflets of *S. paucissectum* are broadly ovate-lanceolate and have a less sharply acuminate apex and a more broadly rounded to slightly cuneate base.

Habitat and Distribution

This species is a member of the *jalca* formation and its neighboring regions, or pre-*jalca*. Its range is very restricted. Its distribution is largely concentrated be-

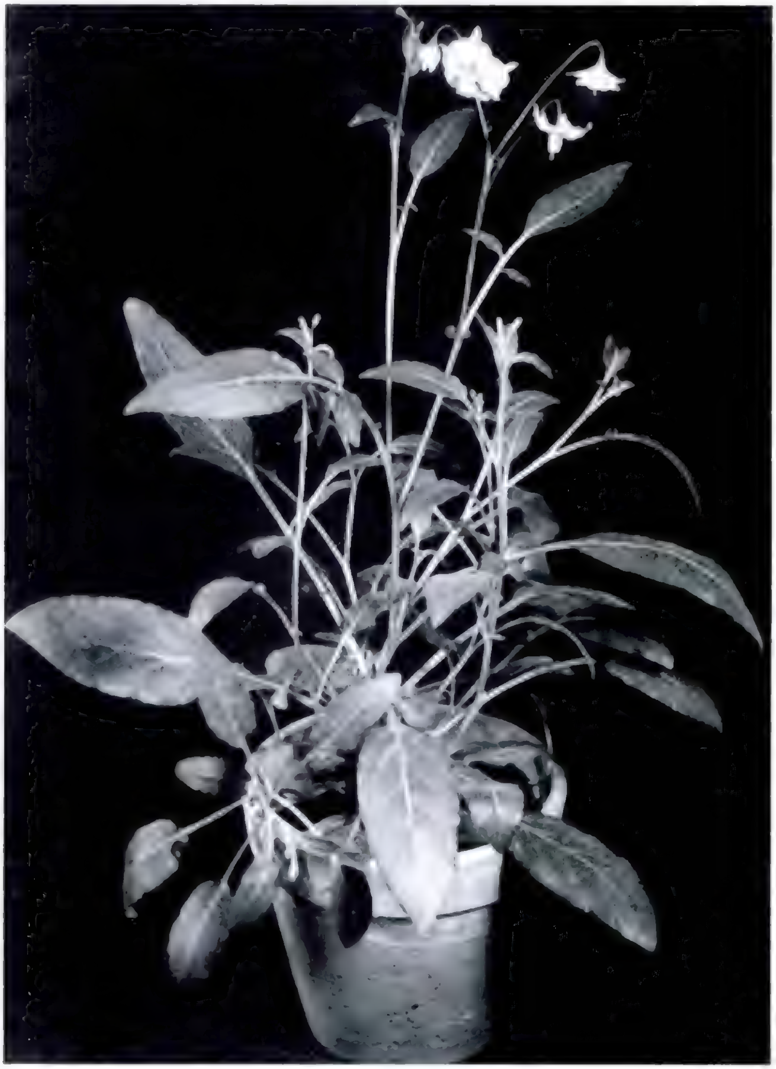


Figure 199. Greenhouse specimen of *Solanum paucissectum*.

tween Cashapampa, Ciénago Largo and Cuello del Indio, along the ascent between Juzgara and the Pass of Cuello del Indio, all localities situated in the mountain division of the Provinces of Morropón and Ayabaca of the Province of Huancabamba, Department of Piura, in northern Peru, where this species occurs usually at elevations between 2600 and 3360 m (Map 15).

Specimens Examined

Department Cajamarca

Province San Marcos: Vicinity of Chugur, 2700 m alt., on poor ground and moist slopes, 19 February 1973, C. *Ochoa 3250* (OCH).

Department Piura

Province Huancabamba: Paso Cuello del Indio, between Canchaque and Huancabamba, *ca*. 3000 m alt., May 1960, *Ochoa S-16 = PI-365340* (CIP, OCH, from plants grown from original seed at Sturgeon Bay, Wis., USA). Paso Cuello del Indio, 3360 m alt., on the Canchaque to Huancabamba road, plants 20-40 cm tall, some rosette forming at base, leaves with 0-1 pair of leaflets, corolla light blue, 4 May 1960, C. *Ochoa 2320* (OCH). Ciénago Largo, 3180 m alt., heading down from the Cuello del Indio Pass toward Huancabamba, near Piedra Bola, much before Juzgara, in open field and very moist soils, in marshland, plants small, some rosette forming, leaves glabrous sub-vernicose at the base, flowers white, 5 May 1960, C. *Ochoa 2321*, 2n=24 (OCH, US, type collection of *S. paucissectum*). Ciénago Largo, 3180 m alt., heading down from Cuello del Indio Pass toward Huancabamba, stems simple, long internodes, flowers light lilac almost whitish with a narrow dark purple border (in the manner of a star) that extends from the acumens to the base of each petal, giving the impression of a bicolor lilac-purple corolla, leaves glabrous, 4 May 1960, C. *Ochoa 2322*, 2n=24 (OCH). High part of Ciénago Largo, 3200 m alt., heading down from Cuello Indio Pass toward Huancabamba, in very moist soils, stems simple, leaves glabrous vernicose, flowers pale blue to light bluish-lilac, fruits long conical, 4 May 1960, C. *Ochoa 2323*, 2n=24 (GH, OCH, US). Ciénago Largo, 3180 m alt., heading down from Cuello del Indio Pass toward Huancabamba, stems simple, long internodes, flowers pale blue-lavender, leaves with 2 pairs of glabrous leaflets, 4 May 1960, C. *Ochoa 2324*, 2n=24 (OCH). Near Cuello del Indio Pass, 3220 m alt., flowers very pale lilac, almost white, March 1968, C. *Ochoa 2682* (OCH, specimen from plant grown at the Universidad Nacional Agraria La Molina, Lima, from original seed). Ciénago Largo, 3180 m alt., stems simple not rosette-like, flowers pale lilac, berries only, March 1968, C. *Ochoa 2683* (OCH, from plants grown at the Universidad Nacional Agraria La Molina, Lima, from original seed). Ciénago Largo, 3180 m alt., plants small and rosette forming at base, flowers white with pale lilac acumens, March 1968, *C. Ochoa 2683A* (OCH, specimens from plants grown at the Universidad Nacional Agraria La Molina, Lima, from original seed). Ciénago Largo, 3050 m alt., km 36 on the Huancabamba to Canchaque road, 20 May 1974, *Z. Huamán 974* (CIP, OCH, US) and (OCH, from plants reproduced 10 May 1988 in the greenhouse at La Molina, Lima, from seed *PI=473489*). Cashapampa, 2950 m alt., about 5 km southwest of Sondorillo, plants small, 30-40 cm tall, flowers pale blue-violet, 20 April 1977, *C. Ochoa 11628*, $2n=24$ (CIP, OCH, US, from original plants) and (OCH, GH, US, from plants grown in the greenhouse at Huancayo). Cashapampa, 2950 m alt., southwest of Sondorillo, only mature berries were collected, 20 April 1977, *C. Ochoa 11629-1*, flowers white with bluish acumens (CIP, GH, MOL, OCH, US, from plants grown in open field at Huancayo), and *11629-2*, flowers light blue (CIP, OCH, from plants grown in the greenhouse at Huancayo). Cashapampa, 2950 m alt., a few km southwest of Sondorillo, in thickets of herbs and shrubs, flowers pale lilac to white-lilac, 20 April 1977, *C. Ochoa 11630* (CIP, OCH, from original plants), (CIP, MOL, OCH, from plants grown in open field at Huancayo) and (CIP, MOL, OCH, US, from plants grown in the greenhouse at Huancayo). Near Casa Candelario, between Juzgara and Ciénago Largo, 2600 m alt., heading up from Huancabamba toward Cuello del Indio Pass, flowers white with a tinge of blue pigment, 20 April 1977, *C. Ochoa 11631* (OCH) and (CIP, GH, MOL, NY, OCH, US, from plants grown in the greenhouse at Huancayo). Vicinity of Cuello del Indio Pass, 3250 m alt., on the Canchaque-Huancabamba road, fruits oval-conical, 20 April 1977, *C. Ochoa 11632* (CIP, OCH, from plants grown in the experimental fields at Huancayo, flowers light violet). Vicinity of Cuello del Indio Pass, 3250 m alt., on the Canchaque-Huancabamba road, fruits long-conical, 20 April 1977, *C. Ochoa 11633* (CIP, MOL, OCH) and (CIP, OCH, MOL, from plants reproduced in the greenhouse at Huancayo from originally collected seed; segregate flowers white and light blue-lavender). Near Cuello del Indio Pass, 3250 m alt., on the Canchaque-Huancabamba road, flowers blue-lavender, 20 April 1977, *C. Ochoa 11634*, $2n=24$ (CIP, GH, OCH, US, from plants reproduced in the fields at Huancayo), (OCH, from plants grown in the greenhouse at Huancayo) and (CIP, OCH, from plants grown in the greenhouse at La Molina). Canganes, 3200 m alt., near Ccasapampa, between Juzgara and Cuello del Indio Pass, corolla pale violet; growing together with other similar tuberous plants but with flowers pale blue-lavender, berries long conical, dark green mottled with vertical stripes and dark green transverse ones, 20-27 May 1982, *C. Ochoa 14816*, $2n=24$ (CIP, GH, OCH, from originally collected plants), and *14816-1* (CIP, GH, MOL, OCH, from plants reproduced from seed in the greenhouse at Huancayo, flowers light sky-blue). Canganes, 3200 m alt., near Ccasapampa, between Juzgara and

Cuello del Indio Pass, along the margins of potato fields, flowers light violet, fruits ovoid to elongated-conical, 20-27 May 1982, C. *Ochoa 14817*, 2n=24 (CIP, GH, OCH, US, from original plants) and (CIP, MOL, OCH, from plants grown in the greenhouse at Huancayo). Canganes, 3200 m alt., near Ccasapampa, between Juzgara and Cuello del Indio Pass, along the margins of potato fields, fruits ovoid to elongate conical, very rarely round, flowers light blue or blue-violet, 20-27 May 1982, *C. Ochoa 14818* (CIP, OCH, from original plants) and (CIP, MOL, from plants grown in the greenhouse at Huancayo). Piedra Angosta, 3000 m alt., heading down from Cuello del Indio Pass toward Canchaque, one plant only, very small, without flowers, stem simple, leaves sparsely pubescent, 20-27 May 1982, *C. Ochoa 14819* (OCH).

Table 53. Fertility of *Solanum paucissectum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	INGAEFOLIA	× *S. raquialatum*	16(6)	0(0)	0(0)
24	1	TUBEROSA	× *S. mochiquense*	44	0	0
24	2	CONICIBACCATA	× *S. chomatophilum*	24(26)	22(7)	21/8
			× *S. contumazaense*	59(26)	29(1)	0(0)
24	2	PIURANA	× *S. cantense*	25	24	53
			× *S. chiquidenum*	22	20	0
			× *S. piurae*	5/4	5(4)	138(118)
24	2	TUBEROSA	× *S. goniocalyx*	10(5)	2(3)	6/0
			× *S. phureja*	42(12)	21(0)	0(0)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

The results of crosses of *S.paucissectum* with diploid (2n=24) species of EBN=1 and EBN=2 are given in Table 53, while the field materials used for these experiments are shown in Table 54.

As may be readily appreciated from a study of Table 53, the results of experimental crossings of *S. paucissectum* with other wild potato species are not always dependent upon the individual ratings of the numerical endosperm balance (EBN). More to the rule, on the other hand, is the fact that crosses between wild diploid species and the cultivated *S. goniocalyx* (or *S. phureja*) are usually unsuccessful, and when these do succeed, berries with very few seeds are obtained. Good success, however, was observed in crosses of *S. paucissectum* with *S. piurae*. This would seem to indicate that this species is more closely related to *S. piurae* than to *S. acroglossum*.

Reciprocal crosses of *S. paucissectum* and *S. chomatophilum* were successful but yielded only a low average number of seeds per berry. Similarly, the unilateral cross of this species with *S. cantense* yielded only a moderate number of seeds per berry (ca. 50).

Table 54. Collections (OCH) used in experimental crosses of *Solanum paucissectum*.

CONICIBACCATA
S. chomatophilum 11856, 13205, 13208
13210, 13213
S. contumazaense 14751
S. chiquidenum 11059, 13965A
S. paucisecctum 11628, 11630, 11631,
11632, 11633, 11634, 14817
S. piurae 13959

INGAEFOLIA
S. raquialatum 13957, 14823

PIURANA
S. cantense 14692, 14828

TUBEROSA
S. goniocalyx 00001, 14502
S. mochiquense 14820, 15995
S. phureja 15052, 15071, 15135, 15332

40. *Solanum piurae* Bitt., Beibl. Bot. Jahrb. 54(119):5-6, 1917.

Figs. 200-201; Map 15; Plate XX.

S. chomatophilum f. *pilosum* Corr., Wrightia 2:180, 1961. Type: PERU. Department Piura [Province Huancabamba], heading up from Canchaque to Paso Cuello del Indio, 19 June 1952, *C. Ochoa 1795* (OCH, US).

Plant erect, small, (15-)40-50 cm tall, glabrous or glabrescent. Stem simple or branched, slender, 3-7 mm in dia. at base, internodes (1.0-)3.0-4.5(-7.0) cm long, straight or somewhat flexed, narrowly winged. Plant stoloniferous and tuber-bearing; stolons 25-40 cm long; tubers round to ovoid, moniliform, small, 1.5-2.5 cm long. Leaves imparipinnate (3.5-)9.5-14.0(-17.0) cm long by (1.5-)6.0-9.0(-12.0) cm broad; petiole short, 7-10 mm, with 2-3(-4) pairs of leaflets and (1-)2-3(-4) pairs of interjected leaflets (increasing in number in exceptionally large plants). Leaves simple at base of stem; leaflets somewhat brilliant and sparsely pubescent, bristly and rough above, glabrous below, the margins shortly pubescent and somewhat spinescent, occasionally somewhat wavy or revolute; rachis very sparsely spinescent. Terminal leaflet slightly larger than the laterals, (3.5-)5.0-7.0(-9.0) cm long by (1.5-)2.0-3.0(-3.5) cm broad, broadly elliptic-lanceolate to narrowly elliptic-lanceolate, narrowly attenuate and pointed at apex, base rounded. Lateral leaflets narrowly elliptic-lanceolate, with pointed apex and obliquely rounded base, sessile to subsessile or occasionally decurrent about the rachis; rarely petiolulate and upto 2.5 mm long; the first pair 4.0-4.5 cm long by 1.0-1.8 cm broad; the third or fourth pair, when present, considerably smaller than the first two pairs. Pseudostipular leaves prominently lunate or simply falcate, (5-)9-15 mm long by (3-)5-9 mm broad, the margins and limb strongly spinescent. Inflorescence terminal and lateral, cymose and cymose-paniculate, usually 8-12-flowered, exceptionally few flowered (2-3), rarely 25-30-flowered. Peduncle short, 4-5(-9) cm long, forked once or twice, slender, 2 mm in dia., glabrous; pedicels long and slender, 20-25(-30) mm long, glabrous, articulated about 4-5 mm below the calyx. Calyx small, 6 mm long, glabrous except for some unicellular or bicellular hairs along the margins, lobes ovate-lanceolate to lanceolate, acuminate, acumens pointed, 1.0-1.5 mm long. Corolla rotate, 2.5-3.0 cm in dia., blue or bluish-purple with white acumens on the external side; margins of the acumens densely pilose (Fig. 200). Anthers lanceolate, 5.5-6.0 mm long, yellowish-orange, base cordate; filaments 1.5 mm long, glabrous. Style 8.5-9.0 mm long, densely papillose along the lower two-thirds of its length; stigma capitate, very small. Fruit subglobose to ovoid, 2.5 cm long, light green with small white dots and somewhat verrucose toward the apex, marbled with dark green at base. Chromosome Number: 2n=24. EBN=2.

Local Name: *Papa de Zorro*.

Type: PERU. Department Piura, Province Ayabaca, above Ayabaca, 2800 m alt., near latitude 4°40' S, May 1912, *A. Weberbauer 6370* (B, destroyed; F, fragment and phototype; GOET, drawing).

Plants of *S. piurae* vary considerably in habit, dissection of the leaves and in terminal leaflet shape depending upon the natural habitat conditions under which they grow. However, when grown experimentally under uniform field conditions, most of the variations observed in nature disappear.

The type of *S. piurae*, which was formerly included in the botanical collections of the Berlin Dahlem Museum, was destroyed in an Allied air raid during World War II. However, there exists a fragment of the type and a photograph of the original in the Chicago Natural History Museum in the United States. Thus, the present treatment of this previously little known species is based partly on the

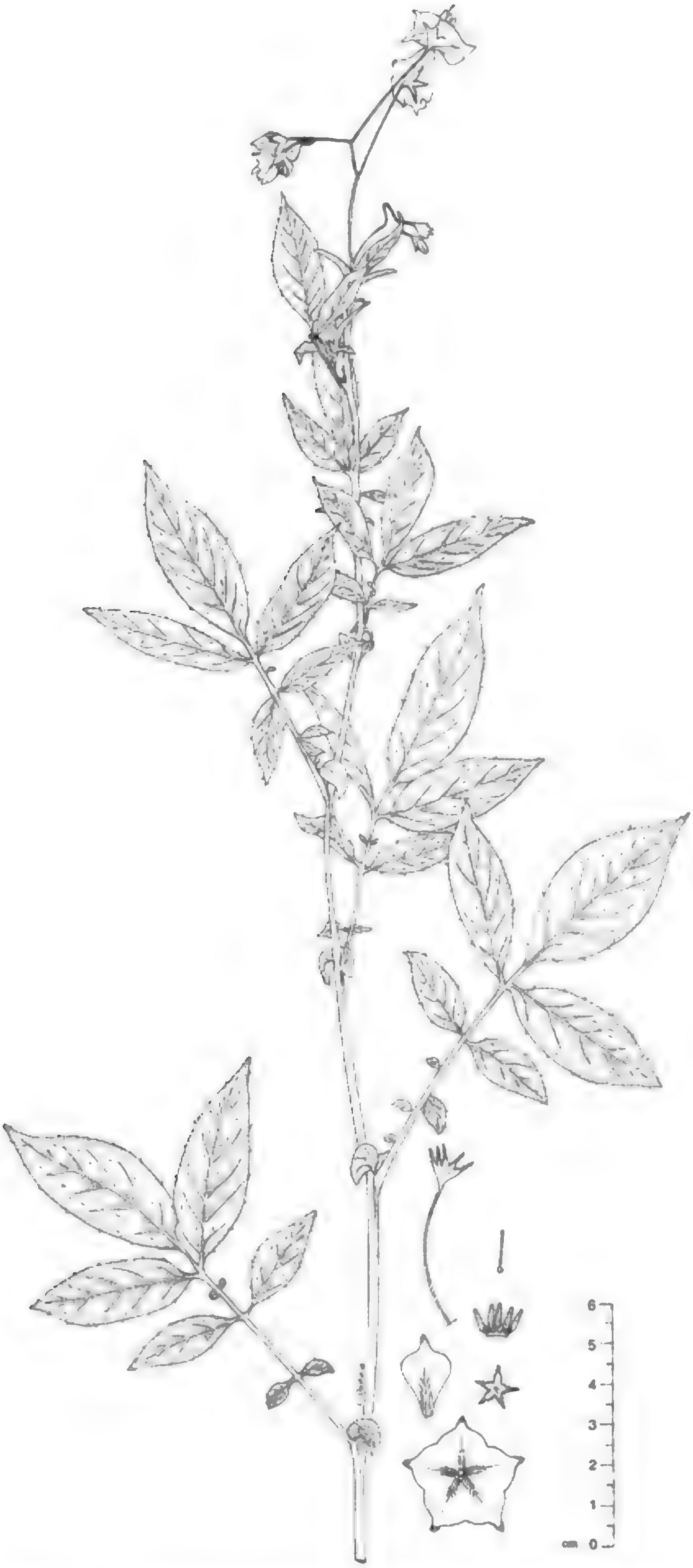


Figure 200. *Solanum piurae* (*Ochoa 2330*, topotype).

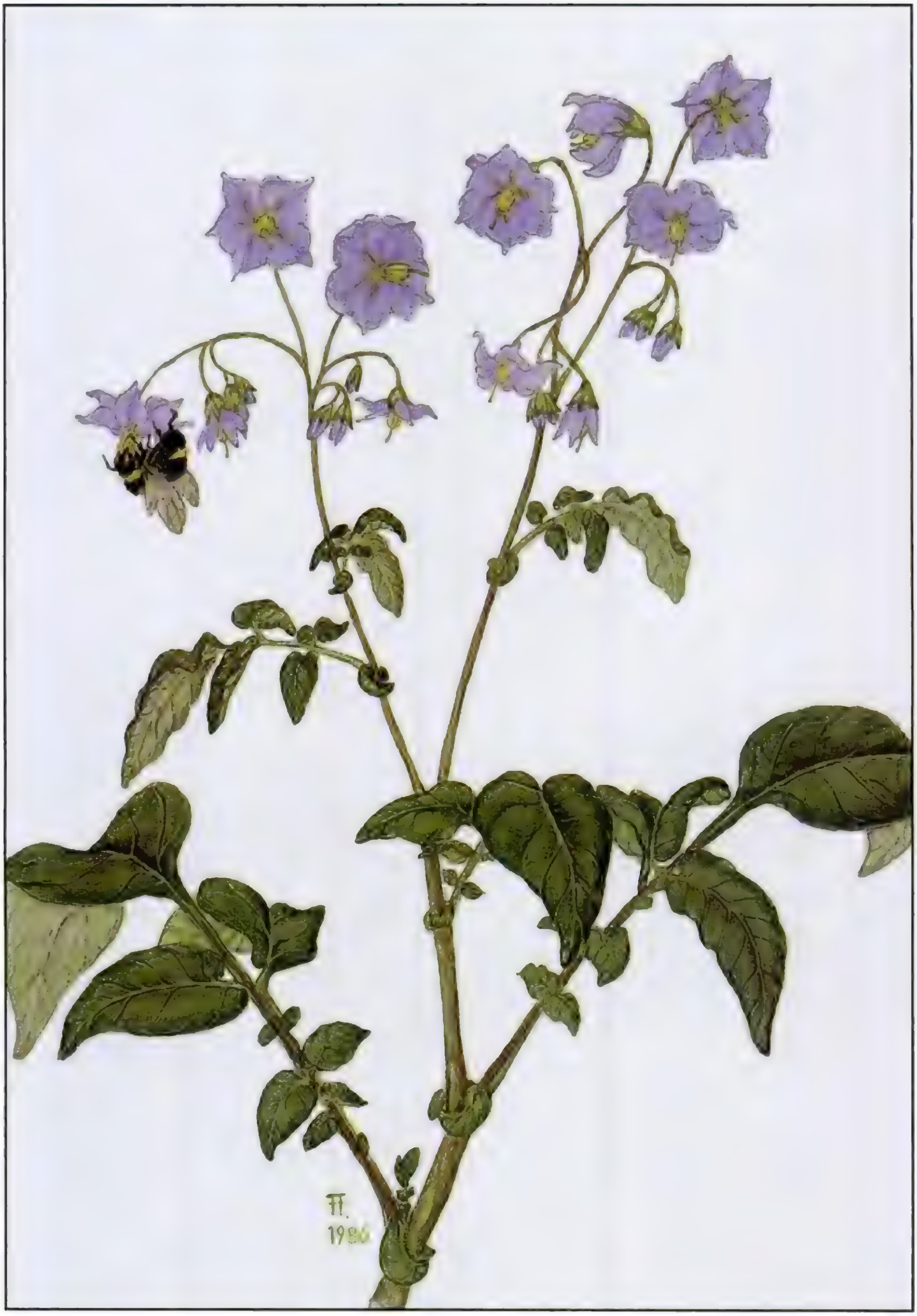


Plate XX. *Solanum piurae* Bitt.

museum materials mentioned above and partly on the appreciable number of new collections that have been assembled in the past 25 years by the present worker as well as by others, including plants from the original type locality (*i.e.* topotypes). These collections, which include many duplicates that are distributed throughout the world today in major museums, have enabled a detailed examination and taxonomic revision to be made of *S. piurae*, a species known currently only from the mountains of the Department of Piura in northern Peru.

Lastly, it should be noted that the various Department of Lima specimens that were cited by Correll (1962, p. 159) as belonging to this species, including *Correll, Smith and Ferreyra P290*, *MacBride & Featherstone 412*, *MacBride 2954*, and *Mathews 771 p.p.*, are all, in the opinion of the present author, *S. cantense*.

Affinities

This species is related to *S. paucissectum*. As noted earlier, these two Peruvian species are highly cross-compatible. However, *S. piurae* also shares some characteristics in common with the Ecuadorian species, *S. paucijugum*

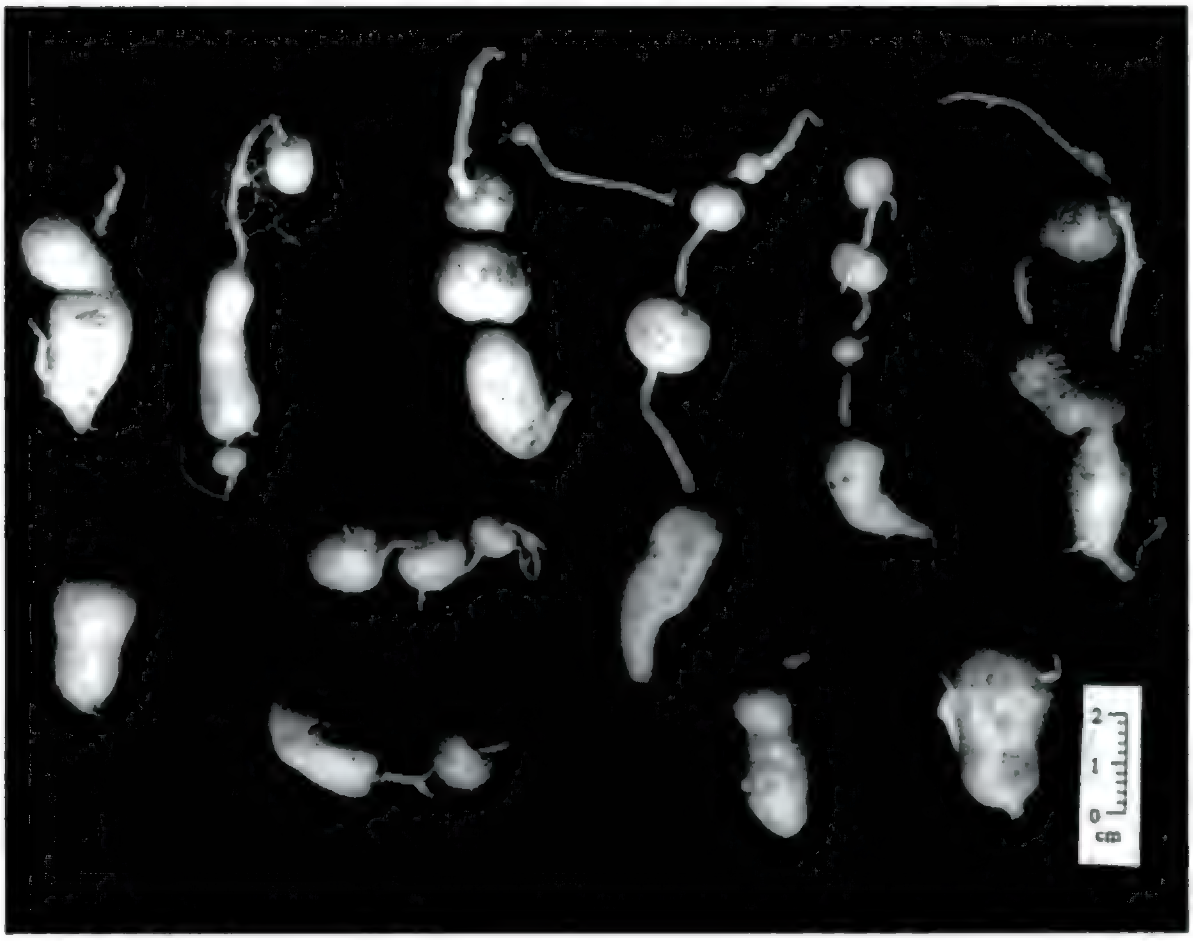


Figure 201. Tubers of *Solanum piurae* (*Ochoa 13959*).

Habitat and Distribution

This species grows preferentially in the moist, organically-rich soils of mountain shrub forests. Here, it grows in close association with other herbaceous plant genera and families such as *Calceolaria*, *Begonia*, ferns, grasses and composites. However, it also grows on steep slopes in poor, rocky soils where it may be associated with few other plant species. In a few areas, it has also been collected with *S. paucissectum*.

Altitudinally, *S. piurae* grows preferentially between 2000 and 2800 m, although it has been reported from areas as high as 3360 m. Its geographical limits lie between latitude 4°38' S and longitude 79°42' W, and 5°22' S and 79°36' W. All known habitats of this species are located in the Department of Piura in northern Peru (Map 15).

Specimens Examined

Department Piura

Province Ayabaca: Coluguero, 2900 m alt., between Arraipite and Ayabaca, about 15 km before Ayabaca, heading up the Chulucanas-Ayabaca road vía Palma, on shrubby slopes, among rocks, flowers blue, 7 May 1960, C. *Ochoa 2329* (OCH, US). Ayabaca, 2800 m alt., in shrub thickets, about 200 m on the right before entering the town while heading up the Chulucanas-Ayabaca road, 7 May 1960, C. *Ochoa 2330*, 2n=24 (topotype OCH). Ayabaca, 2800 m alt., among thicket shrubs in loose moist organic soils, about 100 m before entering the town heading up the Chulucanas-Ayabaca road, flowers blue with whitish acumens, 7 May 1960, C. *Ochoa 2331*, 2n=24 (topotype OCH). Pingola, 2200 m alt., between Arraipite and Ayabaca, very scarce, 8 May 1960, C. *Ochoa 2334* (OCH). Cuesta de Arraipite, 2000 m alt., between Pampas and Pingola, heading up the Chulucanas-Ayabaca road, among large rocks, in poor soils, flowers pale blue with whitish acumens, 8 May 1960, C. *Ochoa 2335* (GH, OCH). Pampa del Lirio, 2600 m alt., a little before coming to Ayabaca, entering by the Chulucanas-Ayabaca road, on shrubby slopes, 17 April 1977, C. *Ochoa and A. Salas 11615*, 2n=24 (OCH, original collection, and CIP, MOL, from plants grown in the greenhouse at Huancayo). Near the borders of the Provinces of Ayabaca and Morropón on the middle slopes of Cerro Mijal, eastern side, 3200 m alt., 6 May 1980, C. *Ochoa and G. Rodríguez 13954*, 2n=24 (CIP, OCH). Palo Blanco, 3000 m alt., about 2 km to the northeastern side of Cerro Mijal, near the right bank of the Palo Blanco River, along the margins of a shrub thicket and in organically rich soils, 5 May 1980, C. *Ochoa and G. Rodríguez 13956*, 2n=24 (CIP, OCH). Near Cruz de Chonta, 2700 m alt., about 3 km before Ayabaca heading up the

Chulucanas-Ayabaca road, on shrubby slopes and poor, rocky soils, 26 June 1984, *C. Ochoa and A. Salas 15795* (CIP, OCH, MOL, US). Above Ayabaca, 2800 m alt., May 1912, *A. Weberbauer 6370* (sheet F No. 647967-fragment, GH-photograph, GOET-drawing, type collection of *S. piurae).*

Province Huancabamba: Near the Cuello del Indio Pass, 3050 m alt., on the Canchaque-Huancabamba road, corolla rotate, violet, 19 June 1952, *C. Ochoa 1795* (OCH), (US, considered by Correll as the type of *S. chomatophilum* f. *pilosum*) and (LL, from plants grown at Sturgeon Bay, Wis., USA). Paso Cuello del Indio, 3280 m alt., on the Chulucanas to Huancabamba road, vía Canchaque, among large rocks and organically rich soils, leaves with 0-1 pair of leaflets, sparsely pilose, flowers blue-violet, 20 June 1952, *C. Ochoa 1798* (OCH, US). Paraje Colorado, 3000 m alt., about 3 km before Tambo, between Canchaque and the Cuello del Indio Pass heading up the Chulucanas-Huancabamba road, 3 May 1960, *C. Ochoa 2314* (OCH, US). Tambo, 3050 m alt., heading up from Canchaque toward the Cuello del Indio Pass on the Chulucanas-Huancabamba road, 3 May 1960, *C. Ochoa 2315* and *2316* (OCH). Cerro Rumitana, 3160 m alt., above Tambo heading up from Canchaque toward the Cuello del Indio Pass on the Chulucanas-Huancabamba road, amid dense scrub and rocky talus slopes, fruits round, flowers bluish with whitish acumens, 4 May 1960, *C. Ochoa 2317*, 2n=24 (GH, OCH, US). Vicinity of the Cuello del Indio Pass, 3300 m alt., on the Chulucanas-Huancabamba road, vía Canchaque, in herb thickets, leaves with 0-1 pairs of leaflets, flowers blue-violet, 5 May 1960, *C. Ochoa 2318* (OCH). Paso Cuello del Indio, 3360 m alt., on the Chulucanas-Huancabamba road, among shrubs and rocks, leaves sparsely pilose, flowers bluish or blue-violet, 4 May 1960, *C. Ochoa 2319* (OCH). Heading up from Canchaque toward the Cuello del Indio Pass, 2900 m alt., on the Chulucanas-Huancabamba road, flowers blue-violet, leaves sparsely pilose, with 1-2 pairs of leaflets, without interjected leaflets, 2 April 1964, *C. Ochoa 2572* (OCH). Cerro Culín, 3200 m alt., along the Huancabamba-Huaringas railroad, 19 May 1974, *Z. Huamán 964* (CIP, OCH). Paso Cuello del Indio, 3100 m alt., km 47 on the Huancabamba-Canchaque road, 20 May 1974, *Z. Huamán 975* (CIP, OCH). Km 48.5 on the Huancabamba-Canchaque road, 3100 m alt., 20 May 1974, *Z. Huamán 976* (CIP, OCH). Lower slopes of Cerro Mishihuaca, 2600 m alt., near Canchaque, amid scrub, flowers light blue, leaves with 3-4 pairs of leaflets and 2-3 pairs of interjected leaflets, 7 May 1980, *C. Ochoa and G. Rodríguez 13959*, 2n=24 (OCH, from plants grown in the greenhouse at Huancayo). Between el Cerro Mishihuaca and Canchaque, 2300 m alt., 7 May 1980, *C. Ochoa and G. Rodríguez 13960*, 2n=24 (CIP, GH, MOL, OCH, US).

Table 55. Fertility of *Solanum piurae* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	INGAEFOLIA	× *S. raquialatum*	14(6)	3(0)	0(0)
24	1	SIMPLICISSIMA	× *S. guzmanguense*	12(11)	0(0)	0(0)
24	2	CONICIBACCATA	× *S. chomatophilum*	258(57)	161(30)	66(66)
24	2	CUNEOALATA	× *S. peloquinianum*	40	14	136
24	2	PIURANA	× *S. ariduphilum*	62(17)	40(10)	50(0)
			× *S. chiquidenum*	58(6)	35(4)	0(21)
			× *S. paucissectum*	4(5)	4(5)	118(138)
24	2	TUBEROSA	× *S. ambosinum*	6(22)	3(12)	0(9)
			× *S. huarochiriense*	5	4	38

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

The results of crosses of *S. piurae* with diploid (2n=24) species of EBN=1 and EBN=2 are given in Table 55, while the field materials used for these experiments are shown in Table 56.

All crosses of *S. piurae* with species of dissimilar EBN value resulted in failure. On the other hand, some degree of success was achieved in all cases involving crosses of *S. piurae* with plants having the same EBN value. The highest degree of success, as noted earlier, was attained in crosses involving *S. piurae* and *S. paucissectum*.

Table 56. Collections (OCH) used in *Solanum piurae* fertility studies.

CONICIBACCATA
S. chomatophilum 11061, 12056, 13010
13196, 13199, 13200, 13202, 13203
13204, 13205, 13206, 13210, 13212
13213, 13341, 14706

CUNEOALATA
S. peloquinianum 13002, 13230

INGAEFOLIA
S. raquialatum 13947, 14823

PIURANA
S. ariduphilum 2637

S. chiquidenum 13965A, 13972
S. paucissectum 11628
S. piurae 13954, 13959, 13960

SIMPLICISSIMA
S. guzmanguense 15991

TUBEROSA
S. ambosinum 11865, 13852
S. huarochiriense 11325

41. *Solanum yamobambense* Ochoa, Agronomía (Lima) 27(4):367-369, illustr., 1960.

Figs. 202-204; Map 16.

Plant erect, (30-)50-60(-70) cm tall. Stem slightly sinuous, usually branched, slender, (3-)4-5(-6) mm in dia. at base, cylindrical, wingless, glabrous or very sparsely pubescent with short hairs, subpigmented or pigmented, internodes (1.5-)2.5-3.5 (-4.5) cm long. Stolons 50-70 cm long; tubers white, moniliform, round to ovoid, small, 1-2 cm in dia. Leaves short and broad, (8.0-)10.0-13.5 (-15.5) cm long by (6-) 7-11(-13) cm wide, coriaceous or subcoriaceous, vernicose, light green and sparsely hispid above, pale green and glabrous below, or pubescent with only a few short hairs on the veins below (Fig. 204); imparipinnate, with 3-4 pairs of lateral leaflets and (2-)3-6(-8) pairs of small, sessile, suborbicular and lanceolate interjected leaflets, 1.5-7.0(-10.0) mm long; petioles short (6-) 8-10(-15) mm long. Leaflets narrowly lanceolate, margins varying from very slightly wavy to subcrenulate or crenulate, the apex long acuminate and the base rounded or asymmetrically rounded; terminal leaflet slightly larger than the first and second pairs of laterals, (6.0-)7.0-8.5(-9.5) cm long by (1.5-)2.0-2.6(-2.8) cm broad; lateral leaflets sessile or very shortly petiolulate, the first and second pairs nearly of equal size, (5.0-)6.0-7.0(-7.5) cm long by (1.2-)1.5-1.8(-2.3) cm broad and the first pair often narrowly decurrent upon the rachis; the lower lateral leaflets considerably smaller than the first two pairs. Pseudostipular leaves falcate or

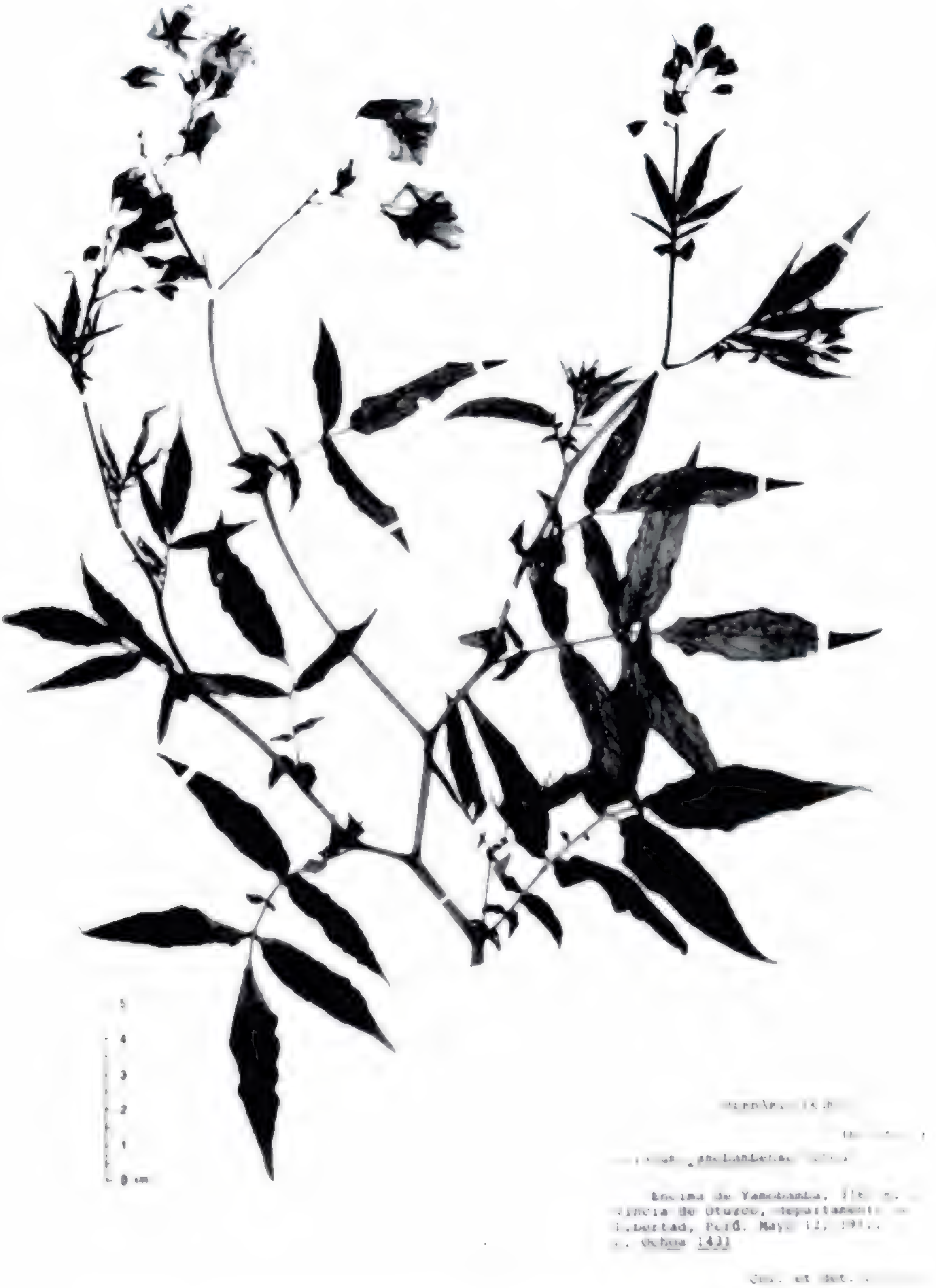


Figure 202. *Solanum yamobambense* (*Ochoa 1431*, holotype).

subfalcate, with broad bases, 7.0-15.5 mm long by 4.0-6.5 mm wide. Inflorescence terminal and lateral, cymose, with 5-15 flowers. Peduncle (1.5-)2.5-5.0 cm long, pigmented or subpigmented, glabrous or glabrescent; pedicels glabrous, 25-35 mm long, articulated 6-8 mm below the calyx. Calyx glabrous, 6 mm long, with elliptic-lanceolate lobes, membranous, the apex abruptly narrowed to 2-3 mm long acumens. Corolla rotate, 2.5-3.0 cm in dia., white, with acumens pigmented violet or dark lilac on the exterior side and an internal star of yellowish-green (Fig. 203). Anthers yellowish-orange, narrowly lanceolate, 6-7 mm long by 1.6-1.8 mm broad at base, subcordate. Style 10.5-11.0 mm long by 0.5 mm thick, exerted 3.5 mm, papillose along the basal two-thirds of its length; stigma ovoid, light green, slightly enlarged at the apex of the style. Ovary ovoid, light green. Fruit ovoid, 12-15 mm long, light green, marked with dark green vertical streaks. Chromosome Number: 2n=24.

Type: PERU. Department La Libertad, Province Otuzco, above Yamobamba, 3160 m alt., 12 May 1952, *C. Ochoa 1431* (holotype OCH).

Affinities

This species is related to *S. chiquidenum*. The two are alike in having a white corolla with pigmented acumens, coriaceous leaves, wingless cylindrical stems and similar-appearing fruits. However, *S. yamobambense* differs markedly from that species in having shorter and more broadly formed leaves that are highly dissected, and in having more narrowly lanceolate leaflets that end in a longer and more pointed apex.

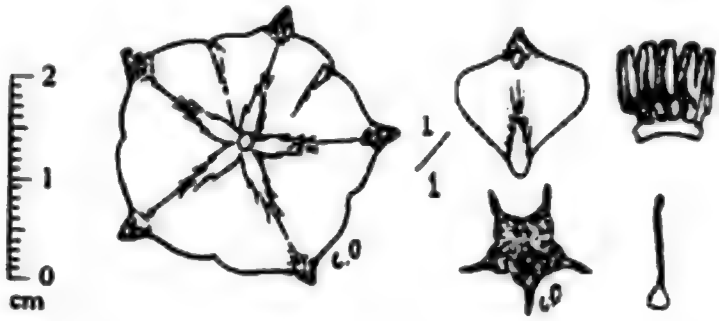


Figure 203. Floral dissection of *Solanum yamobambense* (*Ochoa 1431*, holotype).

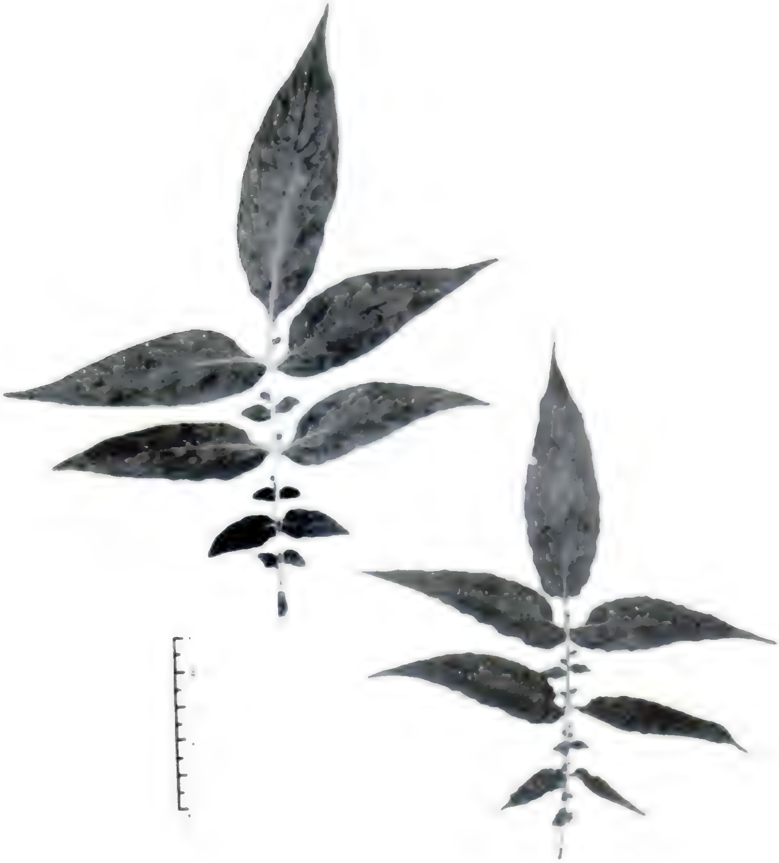


Figure 204. Leaves of *Solanum yamobambense* (*Ochoa 10722*).

material

Habitat and Distribution

This species is known from the smaller valleys and mountain slopes of the Departments of La Libertad and Cajamarca in northern Peru. Within this region, it is commonly found in temperate to cool habitats at altitudes ranging between 2900 and 3200 m. It grows preferentialy in dense thickets of shrubs and herbs, where it may be associated with plants of the genus *Rubus*, *Calceolaria* and *Monnina*, and with various genera and species of the grass and composite families.

Specimens Examined

Department Cajamarca

Province Cajamarca: Collected on the middle slopes of Cerro Pilancones, 2900 m alt., tubers small and moniliform, 1 April 1976, *C. Ochoa 10722*, 2n=24 (OCH).

Department La Libertad

Province Otuzco: Above Yamobamba, 3160 m alt., among large stones in poor soil, 12 May 1952, *C. Ochoa 1431* (holotype OCH).

SERIES SIMPLICISSIMA

SIMPLICISSIMA Ochoa, Rev. Acad. Colombiana de Ciencias Exactas, Físcias y Naturales, Bogotá 27(65):321. 1989.

Plants erect, stoloniferous and tuber-bearing, from small and graceful to vigorous and tall. Stems usually simple. Tubers round, ovoid to ovoid-flattened or long-subcylindrical, white or light brown. Leaves always simple, subglabrous, sessile or subsessile, shortly petiolate, with small to medium or large blades, to conspicuously large. Peduncle short. Pedicels articulated slightly above the midpoint or within the upper one-third of their length. Corolla white to creamy-white, usually rotate, 3-5 cm in diameter. Fruit round to ovoid. Chromosome Number: 2n=24.

Affinities

Series Simplicissima is distinguished by its leaves, which are simple, sessile to shortly petiolate and essentially entire rather than being imparipinnate (*i.e.* divided into pairs of lateral leaflets) as occurs in other series of the section Petota. Through this fundamental characteristic, the series Simplicissima appears to enjoy a relationship (albeit distant) with series Bulbocastana and Morelliformia of Guatemala and Mexico, however, the species of these two endemic series all have very small, stellate corollas.

Distribution

This series, as represented by its type species *S. simplicissimum*, is of limited distribution in the Andes of Peru, occurring from the Department of Cajamarca (7°21' S and 78°51' W) to the Department of Lima (12°06' S and 76°27' W). The two presently known species of the series grow at altitudes between 1600 and 2200 m.

KEY TO SERIES SIMPLICISSIMA

1. Plant vigorous, to 1.5 m tall; stem thick, 12-15 mm in dia., angular, very narrowly winged; calyx asymmetrical; corolla large, 4-5 cm in diameter.. 42. *S. guzmanguense*
1. Plant graceful, to 45 cm tall; stem slender, 2-4 mm in dia., cylindrical, not winged; corolla medium size, about 3 cm in diameter .... 43. *S. simplicissimum*

42. *Solanum guzmanguense* Whalen et Sagást. In Whalen, M.D., A. Sagástegui and S. Knapp, Brittonia 38(1):9-12, Fig. 1, 1986.

Figs. 205-207; Map 18; Plate XXI.

Plant very robust, erect or erect-ascending to subdecumbent, 90-120(-140) cm tall, glabrous. Stem 1.5-1.8 cm in dia. at base, with internodes 2.5-5.0(-6.0) cm long, strongly pigmented purple-dark violet about the midpoint or the basal one-third of its length, simple or branched, slightly flexed, fleshy, triangular with 2-4 mm broad, straight to sinuous, or strongly curled wings, the margins of which are sparsely ciliate; stolons 150 cm or more long; tubers oblong to ovoid-compressed, dark brown, reticulated, 2.5-6.0 cm long (see Fig. 207), white-fleshed. Leaves simple (Fig. 207), large, (8.0-12.0-)14.5-26.0(-30.0) cm long by (4.0-7.5-) 8.5-13.0(-15.5) cm broad, light green and glabrous above and lighter green and very sparsely ciliate on the principal veins below, essentially ovate to obovate or broadly elliptic to suborbicular, the apex obtuse-acuminate to obtuse-apiculate and the base cuneate to rounded or abruptly attenuate and sessile, margins entire to irregularly wavy or weakly denticulate. Pseudostipular leaves ovate or broadly falcate, 7-15(-20) mm long by 4-9(-11) mm broad. Inflorescence terminal or lateral, cymose or cymose-paniculate, generally few-flowered (3-7) or rarely with 14-18-flowered; peduncle glabrous, short, 1-4 cm long, forked, frequently subtended by large bracts; bracts ovate, sessile, broadly decurrent about the pe-

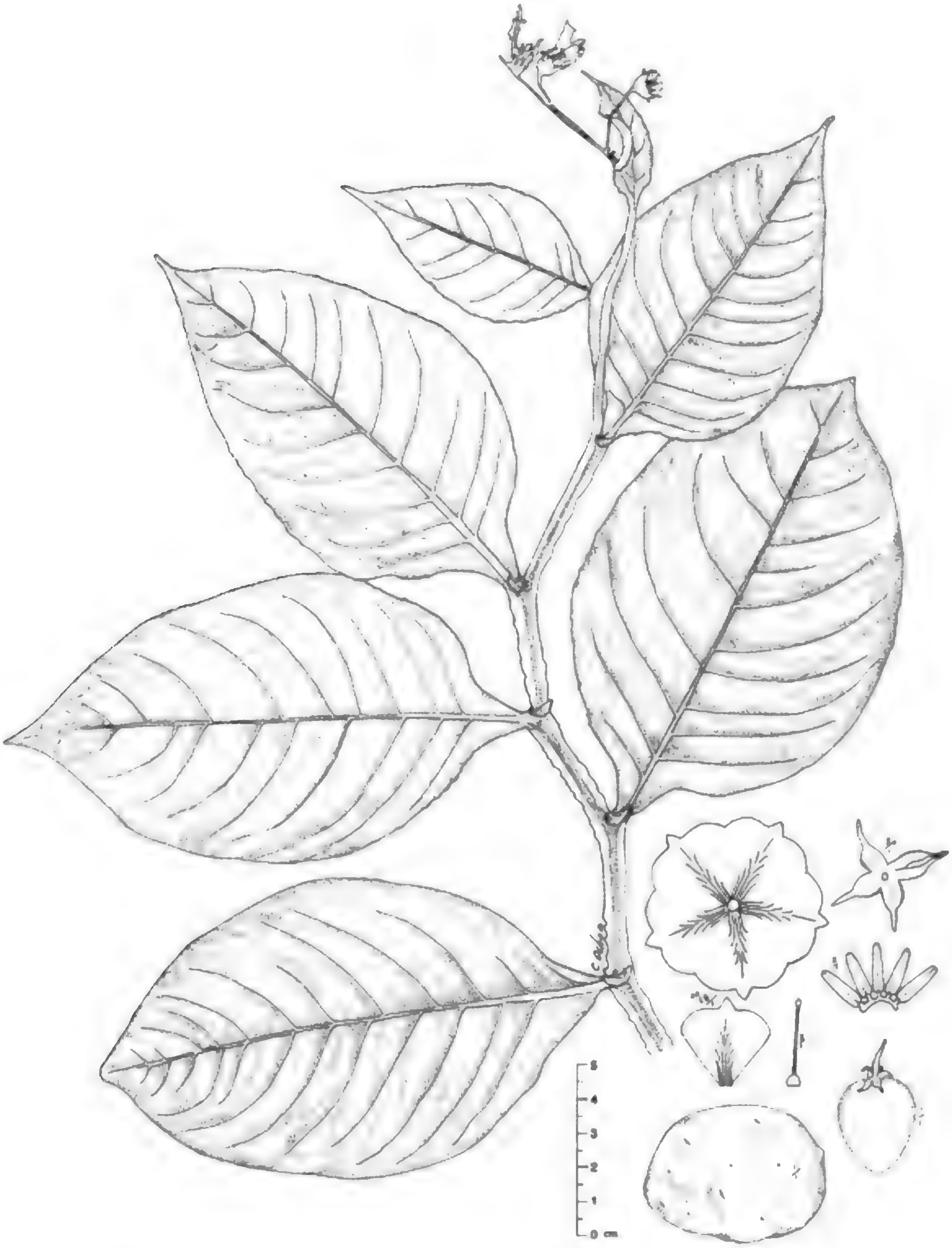


Figure 205. *Solanum guzmanguense* (*Ochoa and Salas 15989*).

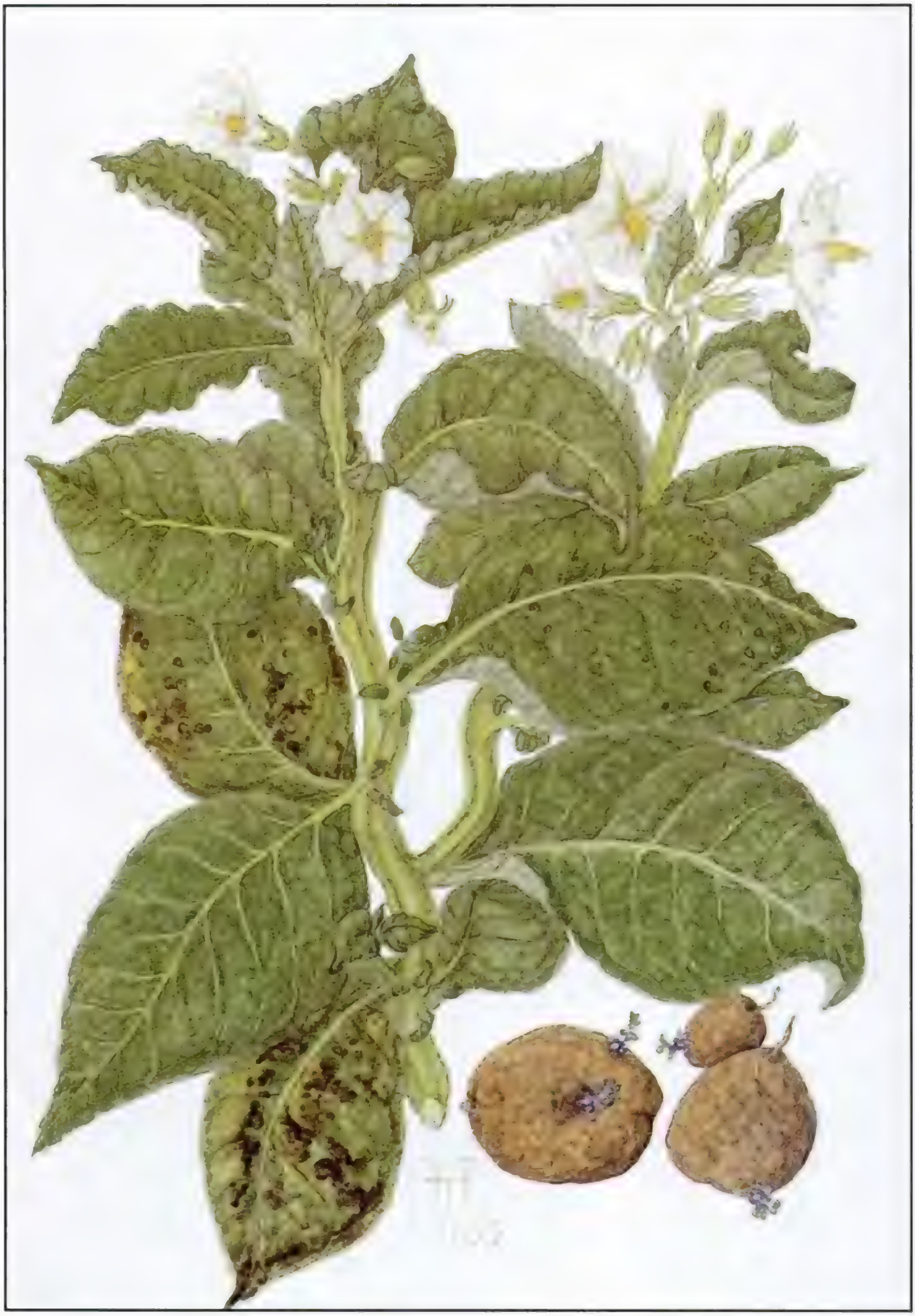


Plate XXI. *Solanum guzmanguense* Whalen et Sagást.

duncle, (5.5-)7.0-15.0 cm long by (2.5-)4.0-7.0 cm broad; pedicels subglabrous like the calyx, slender, 25-35(-45) mm long and 1 mm in diameter; articulated above center or about (6-)8-9 mm below the base of the calyx. Calyx campanulate, asymmetrical, 10 mm long, lobes elliptic-lanceolate, abruptly narrowed at apex, acumens 2.0-2.5 mm long. Corolla white with a yellowish-green internal star, showy, essentially rotate, large, 4.5-5.5 cm in dia. (Fig. 206), with broad lobes and short puberulent-tipped acumens. Anther column cylindrical-conical, asymmetrical; anthers narrowly lanceolate, 7-8 mm long; the dorsal suture scarcely distinguishable toward the apical one-third of the anther's length, base subcordate; filaments 1-2 mm long, glabrous. Style (10-)12(-14) mm long, very slender and sparsely papillose along the basal one-third of its length; stigma claviform, cleft, small, slightly enlarged toward the tip of the style. Fruit oblong to ovoid, 20-25 mm long, light green (Fig. 207). Chromosome Number: 2n=24. EBN=1.

The tubers of this species are difficult to prepare, and when cooked are not only bittersweet and difficult to chew but are hard to swallow.

Type: PERU. Department Cajamarca, Province Contumazá, Yetón, 2200 m alt., between San Benito and Guzmango, moist quebrada, 3 April 1981, *A. Sagástegui, E. Alvitez, E. García and S. López 9714* (holotype HUT, isotype BH).

Although relatively tolerant to attacks by the late blight fungus, *Phytophthora infestans*, this species is very susceptible to viruses PVX and PLRV and *Alternaria solani*.

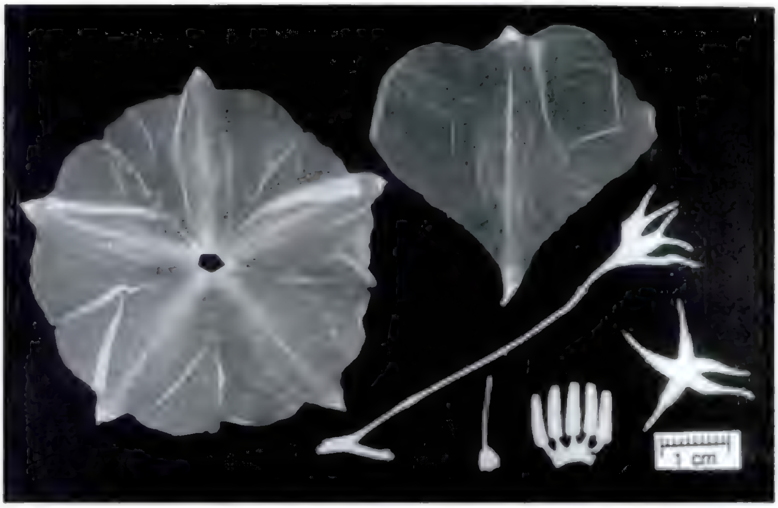


Figure 206. Floral dissection of *Solanum guzmanguense* (*Ochoa and Salas 15989*).

Affinities

Solanum guzmanguense is unique in having several extraordinarily rare characteristics for this tuberous section of *Solanum*, including its conspicuously winged stems, very robust habit and the large simple leaves which resemble those of *Nicotiana tabacum*. The only Peruvian species to which it appears to be related, and then only through its simple leaves and white, rotate corollas, is *S. simplicissimum*. However, because of its robust habit, broadly winged stems and white corolla, the original authors of *S. guzmanguense* believed it was related to *S. simplicifolium* (=*S. microdontum* of series Tuberosa), a species from northwest Argentina and southern Bolivia. The latter species differs from *S. guzmanguense* in being coarsely pubescent and in having imparipinnate leaves that are characteristically divided into 1-2 pairs of lateral leaflets, although occasional leaves may be produced in this species that are simple and decurrent.

The simple leaf character that distinguishes *S. guzmanguense* from *S. simplicifolium* is found also in certain other tuberous species of Guatemala and Mexico, including *S. bulbocastanum*, *S. clarum* and *S. longistylum* (all series Bulbocastana) and *S. morelliforme* (series Morelliformia). These northern hemisphere species differ in having a more delicate habit and white or creamy-white corollas.

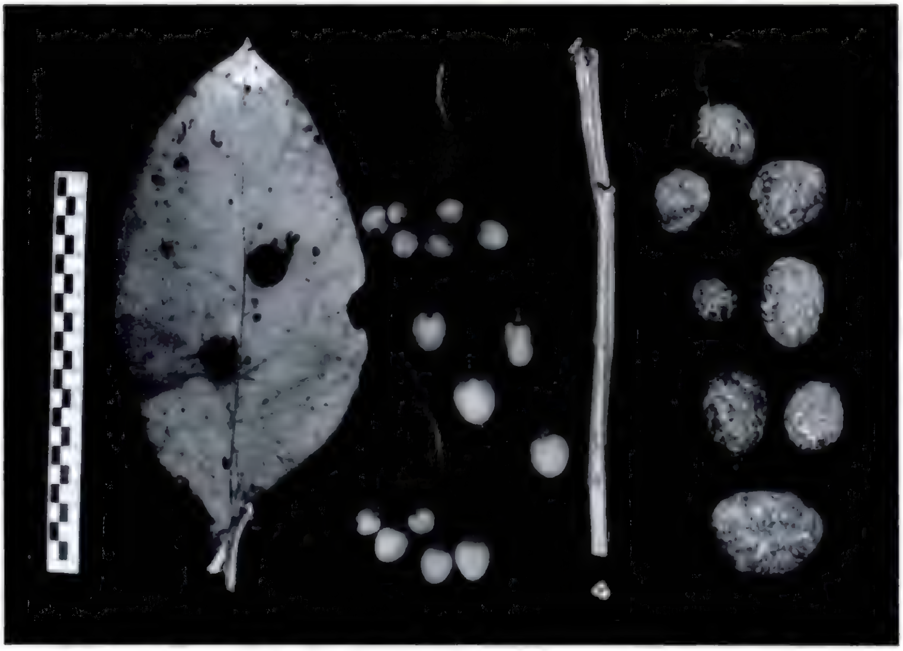


Figure 207. Leaf, fruits and tubers of *Solanum guzmanguense* (*Ochoa and Salas 15990*).

Habitat and Distribution

This species grows at altitudes varying from 1700 to 2200 m in moist quebradas or on rocky slopes in poor lateritic, or sandy-clay soils, preferring climatic zones that range from mild to temperate. It characteristically occurs in thickets of shrubs and herbs dominated by native plants of the composite, mallow and grass families and by herbaceous genera such as *Calceolaria*, *Oxalis*, *Passiflora*, *Begonia* and *Loasa* or by the tree species *Annona cherimolia* and *Caesalpinia spinosa*.

Its distribution is very restricted and strongly endemic to the areas of the countryside surrounding the villages of Yetón, San Benito and Guzmango in the Province of Contumazá, Department of Cajamarca (*ca*. 07°24'S by 78°54' W).

Specimens Examined

Department Cajamarca

Province Contumazá: Yetón, 2200 m alt., moist quebrada between San Benito and Guzmango, 3 April 1981, *A. Sagástegui, E. Alvítez, E. García and S. López 9714* (type collection BH, HUT). Andaloy, 1700 m alt., between San Benito and Yetón, shrubby quebrada, 27 March 1985, *A. Sagástegui and S. Leiva 12519* (BH, HUT). La Cucharilla [La Cuchilla], 2000 m alt., between Yetón and Guzmango, roadside, 27 March 1985, *A. Sagástegui and S. Leiva 12524* (BH, HUT). Chiñac, 2200 m alt., near Guzmango, shrubby rocky hillside, 28 March 1985, *A. Sagástegui and S. Leiva 12536* (BH, HUT). Above Yetón, 1900 m alt., heading up from San Benito to Guzmango, in thickets of a quebrada, near the right bank of the stream of La Cuchilla, flowers white, berries ovoid, 24 March 1987, *C. Ochoa and A. Salas 15989* (topotypes CIP, MOL, OCH, USM). La Cuchilla, 1900 m alt., heading up from Yetón to Guzmango, past the quebrada of the stream La Cuchilla, 24 March 1987, *C. Ochoa and A. Salas 15990* (CIP, MOL, OCH, US, USM, UNTC). Above Cuchilla, 2000 m alt., near Guzmango along the border of barley fields, 24 March 1987, *C. Ochoa and A. Salas 15991* (CIP, GH, MOL, OCH, UNTC, USM, US).

Table 57. Fertility of *Solanum guzmanguense* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	INGAEFOLIA	× *S. raquialatum*	11(16)	0(0)	0(0)
24	1	PIURANA	× *S. hypacrarthrum*	18(14)	0(0)	0(0)
24	1	SIMPLICISSIMA	× *S. simplicissimum*	6	0	0
24	-	TUBEROSA	× *S. immite*	7	0	0
			× *S. mochiquense*	18(22)	0(0)	0(0)
24	2	CONICIBACCATA	× *S. irosinum*	3(4)	0(0)	0(0)
24	2	PIURANA	× *S. cantense*	5	0	0
			× *S. piurae*	11(12)	0(0)	0(0)
24	2	TUBEROSA	× *S. goniocalyx*	4	0	0

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

Despite repeated attempts to cross *S. guzmanguense* with other selected diploid (2n=24) species of EBN values 1 or 2 (see Tables 57 and 58), no seed or berries were obtained. The complete lack of success in these trials can probably be attributed to the genomic uniqueness of *S. guzmanguense*, which from the morphological standpoint, at least, must certainly be regarded as one of the more exotic species of section Petota.

Table 58. Collections (OCH) used in *Solanum guzmanguense* fertility studies.

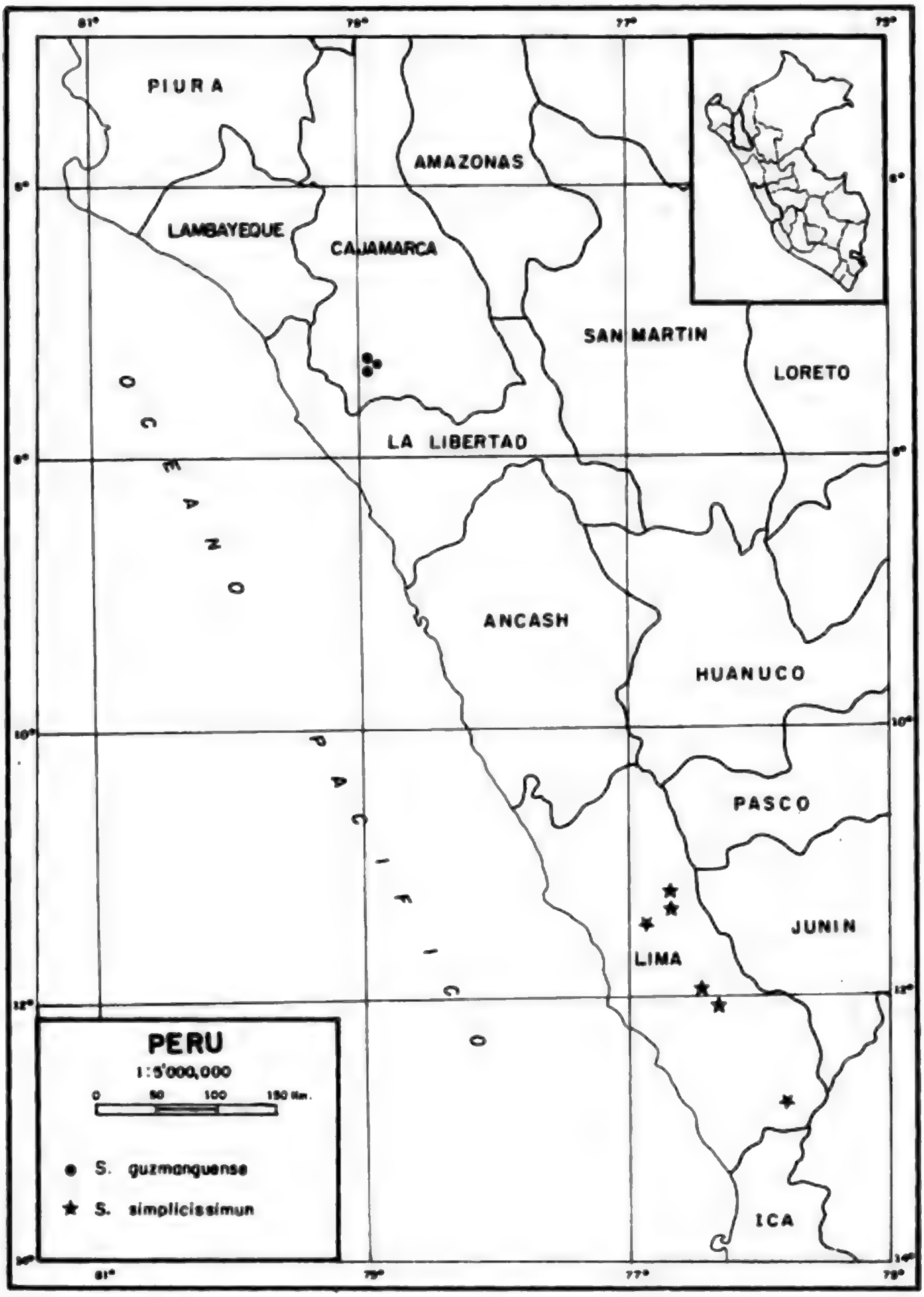
CONICIBACCATA
S. irosinum 15225

INGAEFOLIA
S. raquialatum 13950, 14823

PIURANA
S. cantense 14746
S. hypacrarthrum 11308, 14715, 14731
S. piurae 11615, 13959

SIMPLICISSIMA
S. guzmanguense 15989, 15990, 15991
S. simplicissimun 15147

TUBEROSA
S. goniocalyx 00001
S. immite 15184
S. mochiquense 14870, 15995



Map 18. Distribution of *Solanum guzmanguense* and *S. simplicissimum.*

43. *Solanum simplicissimum* Ochoa, Rev. Acad. Colombiana de Ciencias Exactas, Físicas and Naturales, Bogotá 27(65):321-323, illustr., 1989.

Figs. 208-212; Map 18.

Plant erect, small to medium sized. Stem slender, generally simple, glabrous, slightly woody, cylindrical, wingless, 30-45 cm tall and 3-4 mm in dia. at base, colored dark violet like the peduncles, pedicels and calyx; internodes 2-5(-6) cm long. Stolons 30-40 cm long; tubers white and with few lenticels, small, 1-2 cm long, round to ovoid or long-cylindrical, frequently moniliform. Leaves simple, glabrous or subglabrous, light green and finely textured and somewhat vernicose above and lighter green below with a few short hairs on the veins only. Leaflets ovate-lanceolate to broadly ovate-or elliptic-lanceolate, (5-)9-13(-15) cm long by (2.5-)5.5-6.0(-7.0) cm broad, the apex narrowly attenuate-acuminate or abruptly long acuminate and the base broadly cuneate or occasionally broadly rounded, narrowly decurrent on 2-5(-15) mm-long petioles, irregularly serrate-ciliate along the margins or rarely slightly wavy-crenulate or entire. Pseudostipular leaves conspicuous, broadly subfalcate or asymmetrically ovate-elliptic, 7-12(-18) mm long by 4-7(-9) mm broad. Inflorescence cymose or cymose-paniculate, 3-10-flowered. Peduncle short, 1.5-4.0 cm long, slender, 1.5 mm in dia., glabrous like the pedicels and calyx; pedicels 15-20(-30) mm long, articulated slightly above the midpoint or 7-9(-12) mm below the base of the calyx. Calyx symmetrical, 5.5-6.5 mm long; lobes narrowly ovate-lanceolate, attenuate or narrowed to short, 1.5 mm-long acumens. Corolla rotate 3 cm in dia., white with a yellowish-green internal star; acumens short with densely pilose margins. Anthers narrowly lanceolate, 5-6 mm long, with cordate base and a well-defined basal groove; filaments short, less than 0.8 mm long, finely and sparsely pubescent with short-hairs internally. Style very slender, 8-10 mm long, occasionally glabrous or sparsely papillose along the basal one-third of its length, exerted 3 mm; stigma ovoid or shortly capitate, cleft, very small, gradually enlarging toward the apex of the style. Fruit round, 1.5-1.8 cm in dia., dark green at base, flushed with light green or yellow-green toward apex (Fig. 210). N.v. *Boliche* or *Papa de Gentil*. Chromosome Number: 2n=24. EBN=1.

Local Names: *Ñame* (in Saquisanga, Huarochirí, Lima).

Type: PERU. Department Lima, Province Yauyos, between Cacra and Hongos, 2000 m alt., xerophyte, on rocky mountain slopes, March 1973, *C. Ochoa 4500* (holotype OCH, isotype MOL).

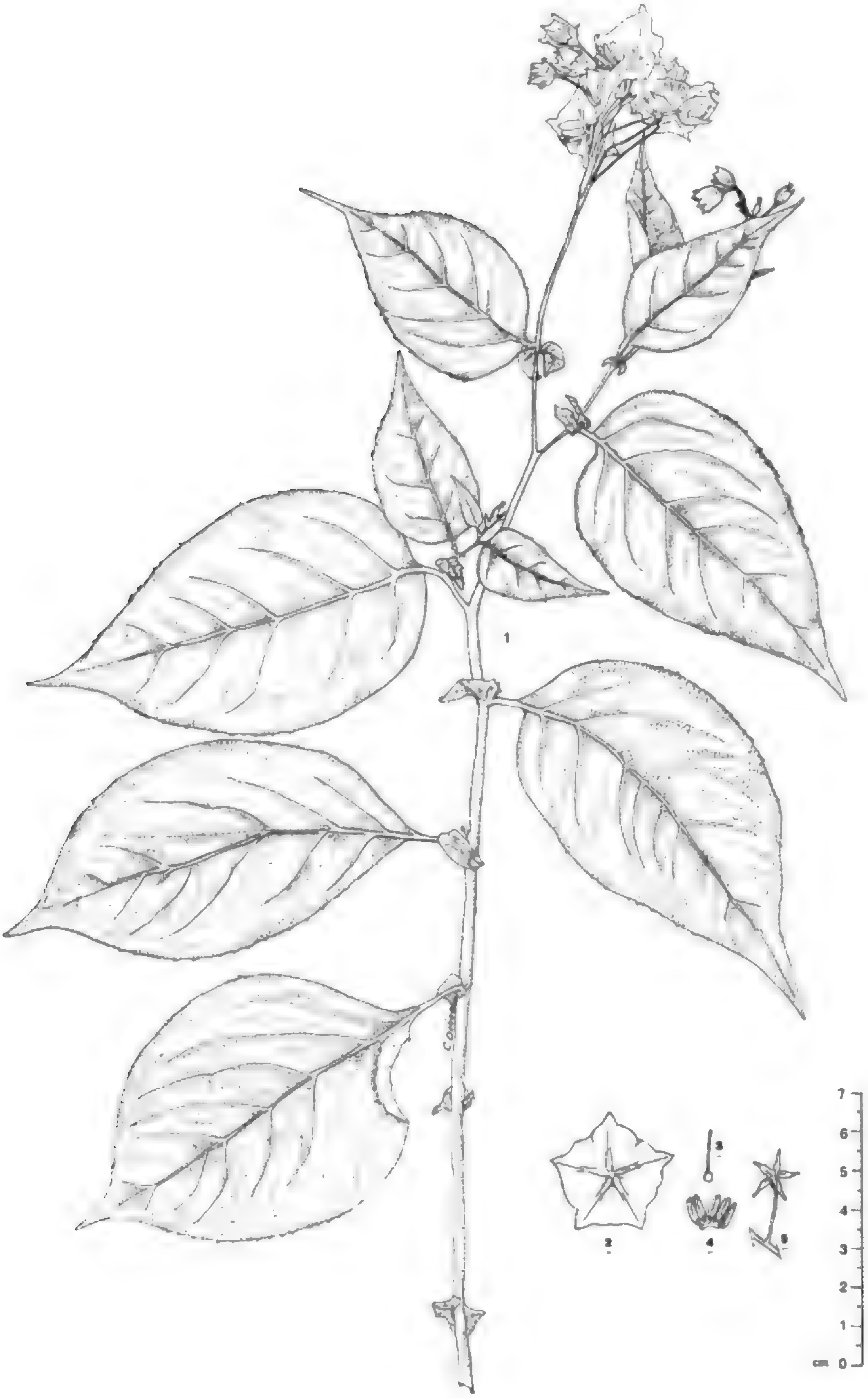


Figure 208. *Solanum simplicissimum* (*Ochoa 4500,* holotype).

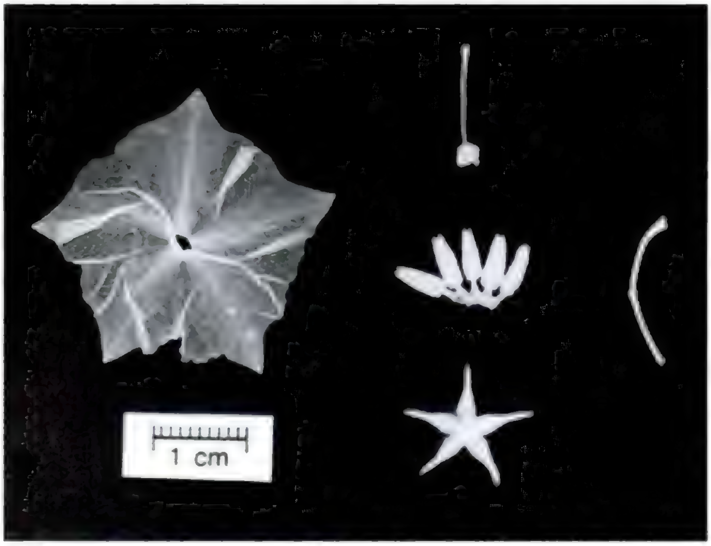


Figure 209. Floral dissection of *Solanum simplicissimum* (*Ochoa* 14628).

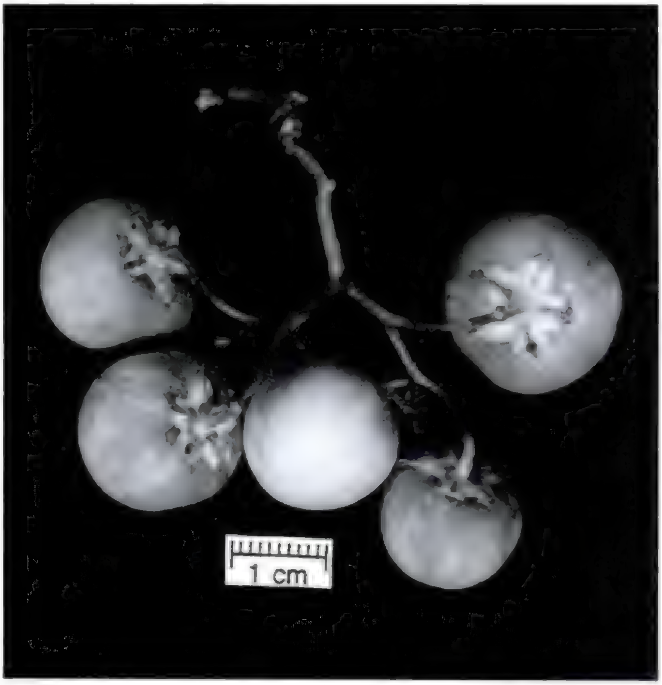


Figure 210. Fruits of *Solanum simplicissimum* (*Ochoa* 15147).

Affinities

This species is similar in several respects to *S. hypacrarthrum*. Both have white flowers and broadly elliptic-lanceolate simple leaves or blades that are sparsely pilose, vernicose, revolute-margined and abruptly acuminate at the apex, and the two are rather similar in habit.

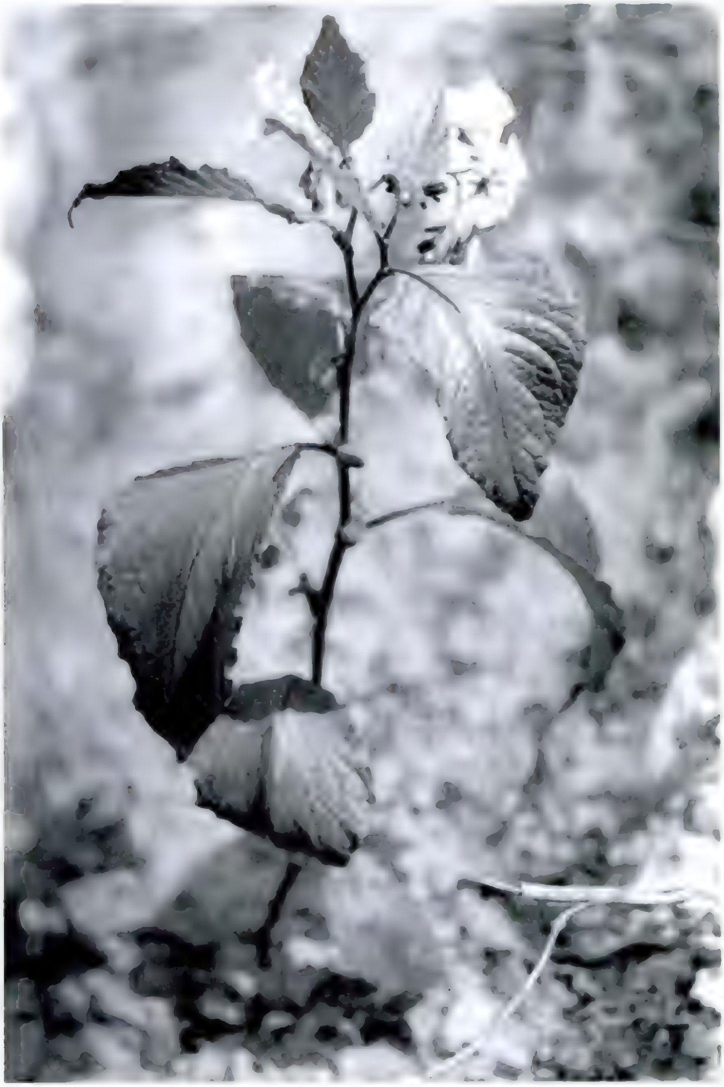


Figure 211. Plant of *Solanum simplicissimum* in its natural habitat.

Habitat and Distribution

Solanum simplicissimum grows preferentially on or near dry, rocky cliffs and slopes, as well as along the borders of cascades and deep quebradas. It occurs alone in barren places or with other xerophytes, including various members of the cactus family (*Melocactus*, *Opuntia*, *Espostoa*, *Mila* and *Trichocereus*; see Fig. 212), pineapple family (*Bromelia*, *Pitcairnia* and *Puya*) and spurge family (*Jatropha*). It has also been collected in association with various herbaceous genera, including *Verbena*, *Oxalis*, *Tropaeolum*, *Lycopersicon pimpinellifolium* and the wild tuber-bearing species, *Solanum medians*.

This species is rare and sparsely distributed in nature. It is known presently only from the Andean region of the Department of Lima, where it occurs at altitudes between 1600 and 2600 m.

Specimens Examined

Department Lima

Province Canta: Distr. of Acos, Tambobamba, 2200 m alt., above Tambo, among stones and columnar and spherical cacti, flowers white, very scarce, March 1982, C. *Ochoa 14628* (OCH). Heading up the Lima-Canta road to 2600 m alt., among large rocks and within compact masses of bromeliads, associated with

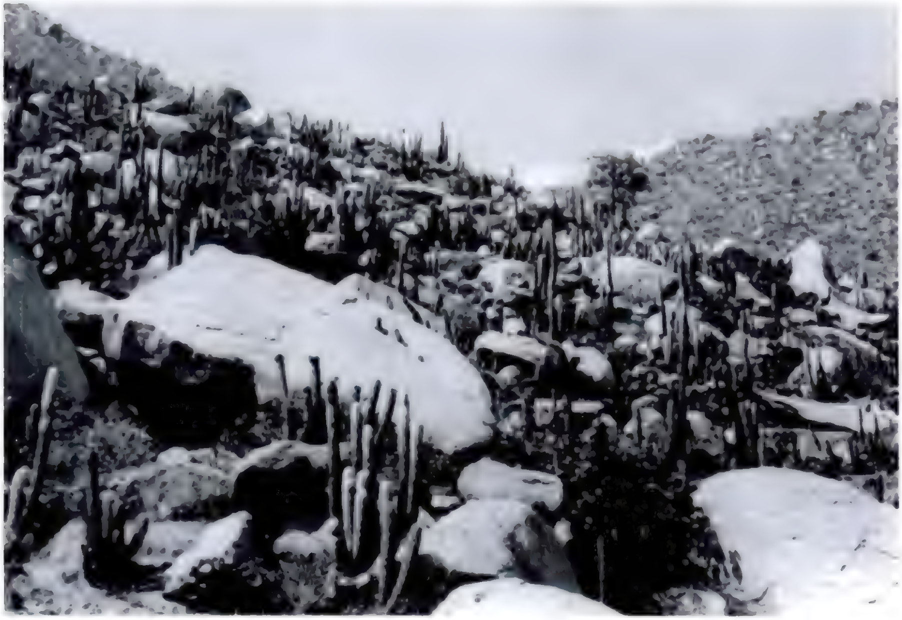


Figure 212. Habitat of *Solanum simplicissimum*, near Santa Rosa de Quives and Canta, March 1979.

grasses and composites, flowers white, scarce, 8 April 1983, *C. Ochoa and A. Salas 15147* (CIP, OCH). Apan, 1600-1700 m alt., on stony hillsides, mountain "*caducifolio*," flowers white, herb 30-40 cm tall, n.v. *Papa de Gentil*, 21 March 1994, *G. Vilcapoma et al. 2949* (MOL, OCH).

Province Huarochirí: Above Antioquia, ca. 1800 m alt., on the road to Langa, among stones and cacti, scarce, n.v. *Ñame*, March 1987, *C. Ochoa 15988* (CIP, MOL, OCH). Near Canchacalla, going up from Lanca, ca. 2400 m alt., January-February 1948, *J. Soukup s.n.*, Leg. *Soukup* (OCH).

Province Yauyos: Between Cacra and Hongos, 2000 m alt., xerophyte, on mountain slopes, among stones, March 1973, C. *Ochoa 4500* (MOL, OCH, type collection of *S. simplicissimum*).

Table 59. Fertility of *Solanum simplicissimum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	TUBEROSA	× *S. mochiquense*	8	1	120
24	2	CONICIBACCATA	× *S. chomatophilum*	11(8)	5(6)	0(0)
		TUBEROSA	× *S. tacnaense*	7	7	0

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Breeding Potential

Negative results were obtained in all crosses involving *S. simplicissimum* (OCH *15147*) and the two diploid species (2n=24), *S. tacnaense* (OCH *14263*) and *S. chomatophilum* (OCH *13204*), both of which are EBN=2 (see Table 59). However, the unilateral cross involving the EBN=1, diploid species *S. mochiquense* (OCH *15995*) yielded a large number of seeds, even though only relatively few pollinations were involved. These results appear to be in line with the general expectations of the theory of numerical endosperm balance, namely, that crosses are compatible when the species involved are of the same EBN value, and incompatible when they are not.

SERIES TUBEROSA

TUBEROSA Rybdb. Bull. Torrey Bot. Club, 51(5):146, 147, 1924 *nom. nud.*

Tuberosa *sensu* Bukasov (Izv. Acad. Nauk U.S.S.R. 711-732, 1938.
Tuberosa *sensu* Hawkes (Bull. Imp. Bur. Pl. Breed. and Genet., Cambridge, p.37, 1944).
Tuberosa (Rydb.) Buk., *sensu strictus* (ex Buk. and Kameraz, Bases of Pot. Breed., p. 18, 1959). Tuberosa (Rydb.) Hawkes (The Potato p. 128, 1990).
Andigena Buk. (ex Buk. and Kameraz, Bases of Pot. Breed., p. 24, 1959).
Transaequatorialia Buk (ex Buk. and Kameraz, Bases of Pot. Breed., p. 21, 1959).
Vaviloviana Buk (ex Buk. and Kameraz, Bases of Pot. Breed., p. 18, 1959).
Andreana Hawkes (Bull. Imp. Bur. Pl. Breed. and Genet., Cambridge, p. 50, 1944, *nom nud.*).
Minutifoliola Correll (Tex. Res. Found Contrib., 4, p. 216, 218-219, 1962).
Pyriformia Gorbat. (Bull. Appl. Bot. Genet. and Pl. Breed. 126:100, 1989).
Bukasoviana Gorbat., incl. his 7 "subseries" (Bull. Appl. Bot. Genet. and Pl. Breed. 126:100-104, 1989).

Plants herbaceous, tuber-bearing; leaves usually imparipinnate, pubescent with few or many glandular hairs, with or without interjected leaflets, rarely with simple leaves glabrous or glabrescent. Inflorescense generally many-flowered, peduncles bifurcate or trifurcate with the pedicels always articulated above center or at base of calyx. Calyx usually symmetrical with short or long-acuminate lobes. Corolla rotate or subpentagonal to pentagonal or rarely substellate, violet, purple, pink, pinkish-violet, blue or blue-violet, rarely white. Anthers 5-7 mm long by 1.5-2.0 mm wide, with abundant pollen, rarely aborted or sterile. Style

7.5-13.0 mm long with a conspicuous capitate or claviform stigma. Fruit globose or more rarely elliptic to ovoid. Chromosome Number: 2n=24, 36, 48 and 60. EBN=2 and EBN=4.

The Series Tuberosa was named by Rydberg in 1924. However, as Rydberg's proposal did not include a latin description for this group, his series name was later treated as a *nomen nudum*. Realizing the need for the maintenance of the original name and concept, Bukasov and Kameraz described this series in Latin in 1959, thus legalizing the standing of this series name.

This series, as represented by its type specimen *S. tuberosum*, is unquestionably the most important group in Section Petota as it contains nearly half of the wild tuberous species of *Solanum* and all of the cultivated ones.

Brücher (1957b) and Correll (1962) regarded this series as occurring only in South America. On the other hand, Hawkes and Hjerting (1989) and Hawkes (1990), while recognizing that the members of this series are primarily distributed in South America, placed one United States species (*S. leptosepalum*) and two Mexican species (*S. macropilosum* and *S. verrucosum*) within the confines of this group. However, Correll (1962, p.388, 390-394), who was the author of the species *S. macropilosum* and *S. leptosepalum*, regarded the latter two species plus *S. wightianum* as members of Series Borealia (this last series treated by Hawkes as a synonym of Series Longipedicellata). Similarly, Hawkes (1963, p. 124) formerly classified *S. macropilosum* as a synonym of *S. polytrichon* under the Series Longipedicellata. However, a more recent treatment by Hawkes (1990, p. 133) places *S. macropilosum* as a good taxonomic species under the Series Tuberosa. Unfortunately, little is known about *S. macropilosum* other than that which can be deduced from the three dried herbarium specimens (deposited at E, GE and MO) that comprise the type collection of this species. This species is not currently known from the living state or from modern field observations.

As for the Mexican species *S. verrucosum*, its serial classification is also in doubt. Although various authors have placed this species in the Series Demissa (*cf.* Correll 1962, p. 360-366; Hawkes 1963, p. 70; Bukasov and Kameraz 1959; Bukasov 1971a, p. 34 and Bukasov 1971b, p. 28), more recently, Hawkes has proposed its placement in Series Tuberosa.

However, despite the confusion that exists in the literature, no one has yet encountered a single wild species in either North America or Central America (including the region of Panama that borders on Colombia) that one could safely point to as being clearly and without doubt a member of the Series Tuberosa. Even the few indigenously cultivated tetraploid varieties of *S. tuberosum* that one encounters in Mexico and Guatemala were originally introduced from South America. Therefore, the geographic distribution of Series Tuberosa would appear to be confined to South America, ranging from about 10°N latitude in Venezuela and extending from there southward along the Andean chain of mountains through Colombia, Ecuador, Peru and southeastern Bolivia to northern Argentina. There are no wild species of Series Tuberosa in Chile, although there are some cultivated varieties of *S. tuberosum* that are known from the central coastal region as well as from the Chiloé Archipelago. The latter varieties, which are believed to be semi-wild or escaped forms of *S. tuberosum*, range as far south as the Peninsula of Taitao, or about 47°S latititude.

The geographic distribution of Series Tuberosa by country in South America is as follows: Venezuela, only one species, *S. paramoense* ($2n=48$); Colombia, two species, *S. andreanum* ($2n=24$; known also from Ecuador) and *S. lobbianum* ($2n=48$); Ecuador, five endemic species, *S. burtonii*, *S. correlli* ($2n=24$), *S. minutifoliolium* ($2n=24$), *S. regularifolium* ($2n=24$) and *S. suffrutescens* ($2n=24$); and, Peru, 55 species, of which 46 are the wild species that are treated in this work, while the remaining 9, all cultivated, will provide the material for a forthcoming volume. Species to be covered in this projected second volume of the Peruvian potatoes include *S. stenotomum* ($2n=24$), *S. goniocalyx* ($2n=24$), *S. phureja* ($2n=24$), *S.* × *ajanhuiri* ($2n=24$), *S.* × *chaucha* ($2n=36$), *S.* × *juzepczukii* ($2n=36$), *S. hygrothermicum* ($2n=48$), *S. tuberosum* ($2n=48$) and *S.* × *curtilobum* ($2n=60$).

With the exception of *S. hygrothermicum*, a species known to be cultivated only in the rainforest zone of Peru, all seven of the remaining cultivated species of potato are also grown in Bolivia. This latter country has 20 wild species of potato, including 3 endemic tetraploids (*S. hoopessi*, *S. sucrense* and *S. ugentii*), 9 endemic diploids (*S. alandiae*, *S. berthaultii*, *S. brevicaule*, *S. doddsii*, *S. gandarillasii*, *S. neocardenasii*, *S. vidaurrei*, *S. virgultorum* and a diploid form of *S. sucrense*), and 4 diploid species which are common to both Peru and Bolivia (*S. candolleanum*, *S. leptophyes*, *S. puchupuchense* and *S. sparsipilum*). Moreover, the Series Tuberosa is represented in Argentina by 6 endemic diploid species (*S. kurtzianum*, *S. neorosii*, *S. setulosistylum*, *S. spegazzini*, *S. venturii* and *S. vernei*), and by 3 diploid species that are found in both Bolivia and Argentina (*S. gourlayii*, *S. microdontum* and *S. okadae*) and a single polyploid (*S. oplocense*).

All told, eighty-four species of Series Tuberosa are known for South America, with the greatest concentration being in Peru (55 species). However, these figures do not take into account the many unverified hybrids and species variants which are treated by other authors, and which are dealt with in the present work as synonyms (cf. Brücher, 1954, 1962a, 1966-1967, 1968 and 1979; Hawkes, 1963, 1990; Hawkes and Hjerting, 1969; Okada and Clausen, 1983).

The majority of the species of Series Tuberosa are found in cool mountain districts. They occur in various phytogeographical formations, including the high páramos (2500-3500 m alt.) of Venezuela, Columbia and Ecuador, the jalcas of northern Peru (3000-3600 m alt.), the punas of central and southern Peru, Bolivia and northern Argentina (3400-4400 m alt.) and the prepunas or precordillera of Argentina (2900-3400 m alt.). Other species, on the other hand, although less numerous, occur in the temperate climate of the Ceja de Monte or in subtropical regions and tropical rainforests. In Peru, still other species grow either in the very high mountain districts or are adapted to survive in the low hills (150-700 m alt.) or loma formations of the coast of central and southern Peru.

On the whole, the Peruvian species of this series represent a potentially valuable genetic resource for the plant breeder. Within this group one finds genotypes resistant to various fungal, bacterial and viral diseases, as well as to other plant plagues. Thus, with respect to Bacterial wilt, a disease caused by *Pseudomonas solanacearum* (Martín *et al.*, 1980; Corsini and Pavek, 1986; Fernández, B. *et al.*, 1987), there are a number of resistant species one can use in breeding, including *S. bukasovii*, *S. bukasovii* f. *multidissectum*, *S. candolleanum*, *S. coelestispetalum*, *S. huancabambense*, *S. leptophyes* and *S. tapojense* (CIP, 1977, 1981, 1982, 1985, 1986-87 and 1988; French and Ochoa, 1986; French and Siqueira, 1988; Schmiediche and Martin, 1983 and 1986; Chujoy *et al.*, 1991). Species resistant to Black-leg disease (caused by *Erwinia carotovora*) include *S. acroscopicum*, *S. ambosinum*, *S. bukasovii*, *S. bukasovii* f. *multidissectum*, *S. huancabambense*, *S. leptophyes*, *S. marinasense*, *S. mochiquense*, *S. pampasense*, *S. scabrifolium*, and *S. sparsipilum* (Huamán *et al.*, 1988; Lejkowska and Kelman, 1989; Bamberg *et al.*, 1994), while resistance to Ring rot (or *Corynebacterium sepedonicum*) is found in *S. bukasovii* f. *multidissectum*, *S. chancayense*, *S. huancabambense*, *S. pampasense* and *S. sparsipilum* (Bamberg et al., 1994; Kurowoski and Manzer, 1990).

Various Peruvian species are resistant to fungal disease. According to Bamberg, Martin et al. (1994), the major disease-causing organisms and their sources of resistance are as follows: *Alternaria solani* or Early blight (*S. bukasovii*, *S. immite* and *S. multiinterruptum*); *Fusarium* spp. or Dry rot (*S. marinasense*, *S. medians* and *S. pampasense*); *Rhizoctonia solani* or Black scurf (*S. marinasense* and *S. sparsipilum*; *cf.* Vlasova, 1974); *Verticillium* spp. or Wilt (*S. acroscopicum*, *S. chancayense*, *S. huancabambense*, *S. immite*, *S. leptophyes*, *S. marinasense*, *S. medians*, *S. mochiquense*, *S. multiinterruptum*, *S. pampasense*, *S. scabrifolium*, *S. sandemanii* and *S. sparsipilum*; *cf.* Bazán de Segura and Ochoa, 1959). Resistance of *S. bukasovii* to *Verticillium* wilt has also been reported by Concibido and Jansky (1991).

Numerous studies have been directed toward the finding of virus resistant strains of potato (Cockerham, 1951 and 1957; Geransenkova, 1974; Rodríguez, 1987; and Bamberg et al., 1994). As of the present date, the major viral organisms or diseases and their known sources of resistance are as follows: PLRV or Potato leaf roll virus (*S. bukasovii*, *S. huancabambense*, *S. marinasense*, *S. medians*, *S. mochiquense*, *S. multiinterruptum*, *S. pampasense* and *S. sparsipilum*); PSTV or Potato spindle tuber viroid (*S. bukasovii*, *S. immite*, *S. marinasense* and *S. medians*); PVM or Potato leafrolling mosaic (*S. bukasovii*, *S. chancayense*, *S. marinasense*, *S. medians*, *S. mochiquense*, *S. multiinterruptum* and *S. sparsipilum*); PVS or Potato virus S (*S. marinasense*, *S. medians*, *S. mochiquense* and *S. multiinterruptum*); Virus X (PVX) or Latent mosaic (*S. leptophyes*, *S. marinasense*, *S. medians* and *S. pampasense*; cf. CIP, Inf. Anual 1979; Hinostroza De Lekeu, 1979; Brown et al., 1984; Querci et al., 1993a and 1993b); Virus Y (PVY) or Severe mosaic (S. ambosinum, S. bukasovii, S. pampasense, S. sparsipilum and other wild species and hybrids; cf. Fernández-Northcote, 1983; Fernández-Northcote et al., 1986; Singh et al., 1979; Ross and Baerecke, 1950; and Ross, 1960a); and Tobacco rattle virus (S. bukasovii, S. mochiquense, S. multiinterruptum and S. sparsipilum; cf. Bamberg et al., 1994).

Insect resistance in this group of potatoes has been reported by Torka (1950) and Flanders *et al.* (1992). The chief insect pests of the potato and the species which show the greatest amount of resistance to these are as follows: Colorado potato beetle or *Leptinotarsa decemlineata* (*S. ambosinum*, *S. bukasovii*, *S. chancayense*, *S. immite*, *S. leptophyes*, *S. marinasense* and *S. multiinterruptum*; *cf.* Radcliffe, 1986; Sanford and Cantello, 1989; Bamberg *et. al.*, 1994); Flea beetle or *Epitrix cucumeris* (*S. bukasovii*, *S. immite*, *S. marinasense*, *S. medians*, *S. mochiquense* and *S. multiinterruptum*; *cf.* Sleesman, 1940; Flanders and Radcliffe, 1986 and 1992; Bamberg *et al.*, 1994); Leaf hopper or *Empoasca fabae* (*S. acroscopicum*, *S. bukasovii*, *S. marinasense* and *S. sparsipilum*; *cf.* Radcliffe and Lauer, 1968); Potato aphid or *Macrosiphum euphorbiae* (*S. acroscopicum*, *S. ambosinum*, *S. bukasovii*, *S. chancayense*, *S. huancabambense*, *S. leptophyes*, *S. marinasense*, *S. medians*, *S. multiinterruptum*, *S. scabrifolium* and *S. sparsipilum*; *cf.* Radcliffe and Lauer, 1966 and 1968; Radcliffe *et al.*, 1981); Peach aphid or *Myzus persicae* (*S. acroscopicum*, *S. bukasovii*, *S. cajamarquense*, *S. huancabambense*, *S. marinasense*, *S. medians* and *S. multiinterruptum*; *cf.* Radcliffe and Lauer, 1968; Radcliffe *et al.*, 1981; Bamberg *et al.*, 1994); and the Potato tuber moth or *Phthorimaea operculella* (*S. bukasovii* f. *multidissectum* and *S. sparsipilum*; *cf.* CIP, 1980, 1983, 1990, 1991; Scurrah, 1986; Chávez, Schmiediche, Jackson and Raman, 1988; Estrada and Valencia, 1988). The potato tuber moth, in particular, has become a very serious threat to potato farmers in Peru.

A number of wild Peruvian potato species of this series have been reported to show some resistance to attacks by nematodes. The genera and species of nematodes and their sources of resistance are as follows: Root knot nematode or *Meloidogyne* spp. (*S. ambosinum*, *S. bukasovii* and *S. sparsipilum*; *cf.* CIP, 1979, 1980, 1990, 1992; Mendoza and Jatala, 1977-1978, 1985; Iwanaga *et al.*, 1989); *Meloidogyne incognita acrita* (*S. sparsipilum*; *cf.* CIP, 1974, 1977, 1978 and 1989; Jatala and Martin, 1978, Gómez *et al.*, 1983); *Meloidogyne hapla* (*S. acroscopicum*, *S. ambosinum*, *S. bukasovii*, *S. chancayense*, *S. huancabambense*, *S. leptophyes*, *S. marinasense*, *S. medians*, *S. mochiquense* and *S. sparsipilum*; *cf.* Bamberg *et al.*, 1994); Potato cyst nematode or *Globodera rostochiensis* and the Potato root eelworm or *G. pallida* (*S. bukasovii*, *S. leptophyes*, *S. marinasense* and *S. sparsipilum*; *cf.* Toxopeus and Huijsman, 1953; Ellenby, 1952 and 1954; Hort, 1955; Dunnet, 1959; Stelter and Rothacker, 1965; Rothacker *et al.*, 1966; Ross and Huijsman, 1969; CIP, 1973, 1978, 1979, 1980, 1981, 1989, 1990; Parrott, 1981; Soest, 1983; Scurrah and Franco, 1985; Chávez *et al.*, 1988a and 1988b); and False root knot nematode or *Naccobus aberrans* (*S. sparsipilum*; *cf.* Hooker, 1980).

Moreover, during the past year at CIP, there have been renewed efforts under the direction and collaboration of Dr. Javier Franco to search for sources of resistance to the cyst nematodes *Globodera pallida* and *G. rostochiensis*. The preliminary results of these studies suggest that at least four species, *S. bukasovii*, *S. coelestispetalum*, *S. marinasense* and *S. multiinterruptum*, show some resistance to the two known pathotypes of *Globodera pallida* (P_4A and P_5A).

Finally, while investigations on frost resistance in plant species (including the effects of abrupt temperature drops) were conducted by Firbas (1961 and 1962) and still earlier workers, it has been only during the past two decades that we have seen an acceleration of work along this line. Today, several new sources for the incorporation of resistant genes are known, including from the species *S. bukasovii*, *S. huancabambense* and *S. medians* (CIP, Inf. Anual 1973, 1976, 1978 and 1985; Palta, Chen and Li, 1981; Hwei-Hwang Chen, Yan Shen and Li, 1982; Bamberg *et al.*, 1994; and Vega and Bamberg, 1995). Heat resistance has also been studied in *S. bukasovii* f. *multidissectum*, *S. mochiquense*, *S. pampasense* and *S. sparsipilum* (Bamberg, 1994 and 1995), and the interrelationships between heat and cold resistance in tuberous *Solanum* species by Hwei-Hwang Chen, Zheng-Yan Shen and Li (1982) and Palta *et al.* (1981).

KEY TO SERIES TUBEROSA

1. Corolla pentagonal .... 60. *S. huancabambense*
1. Corolla rotate-pentagonal to rotate.
  2. Corolla rotate-pentagonal.
    3. Corolla white .... 57. *S. chillonanum*
    3. Corolla of various colors but never white.
      4. Flowers sky-blue .... 50. *S. augustii*
      4. Flowers blue, blue-violet or purple.
        5. Flowers blue, blue-violet or pale violet.
          6. Flowers medium-sized, 2.7-3.0 cm in dia. .... 52. *S. bill-hookeri*
            7. Interjected leaflets (0-)3-8 pairs.
              8. Lateral leaflets (3-)5-7 pairs.
                9. Pedicels articulated in the upper one-third of their length, or sometimes near midpoint .... 66. *S. leptophyes*
                9. Pedicels articulated at center or slightly below center .... 85. *S. tarapatanum*
              8. Lateral leaflets 4-5 pairs .... 67. *S. longiusculus*
            7. Interjected leaflets 9-10 pairs, or more .... 53a. *S. bukasovii* f. *multidissectum*
          6. Flowers large, 3.5-4.0 cm in dia.
            10. Interjected leaves 0-2 pairs .... 47. *S. ancophilum*
            10. Interjected leaves 5-6 pairs .... 53. *S. bukasovii*
        5. Flowers lilac, violet or purple.
          11. Corolla lilac, very large, more than 4 cm in dia .... 89. *S. wittmackii*
          11. Corolla violet or purple, usually less than 4 cm in dia.
            12. Corolla violet, small, 2.0-2.5 cm in dia. .... 51. *S. aymaraesense*
            12. Corolla purple, large, 3.5-4.0 cm in dia. .... 45. *S. amayanum*
  2. Corolla rotate.
    13. Flowers white.
      14. Flowers medium-sized, 2.7-3.0 cm in dia.
        15. Interjected leaflets 3-6 pairs.
          16. Lateral leaflets 5-6 pairs .... 63a. *S. immite* var. *vernale*
          16. Lateral leaflets 3-5 pairs .... 63. *S. immite*
        15. Interjected leaflets 2 or more pairs.
          17. Interjected leaflets 5-6 pairs ..... 54. *S. cajamarquense*
          17. Interjected leaflets 7 or more pairs.

18. Lateral leaflets 3-4 pairs .... 71. *S. mochiquense*
18. Lateral leaftets 6 or more pairs .... 59. *S. gracilifrons*
14. Flowers large, 3 cm or more in dia.
19. Corolla 3.5-4.0 cm in dia.
20. Leaves without interjected leaflets .... 56. *S. chancayense*
20. Leaves with numerous interjected leaflets .... 87. *S. trinitense*
19. Corolla very large, more than 4 cm in dia.
21. Interjected leaflets 0-2 pairs .... 64. *S. incahuasinum*
21. Interjected leaflets numerous .... 72a. *S. multiinterruptum* f. *albiflorum*
13. Flowers variously colored but never white.
22. Corolla sky-blue.
23. Leaves sparsely pilose; Plants of medium height, 35-70 cm tall .... 72b. *S. multiinterruptum* var. *machaytambinum*
23. Leaves pilose; Plants large, 100-150 cm tall .... 58. *S. coelestispetalum*
22.Corolla blue, lilac, violet or purple.
24. Flowers blue.
25. Flowers small, 2.0-2.5 cm in dia. .. 78. *S. sarasarae*
25. Flowers larger, more than 2.5 cm in dia.
26. Flowers medium-sized, 2.7-3.0 cm in dia.
27. Interjected leaflets 0-2 pairs .... 62. *S. huarochiriense*
27. Interjected leaflets 3 or more pairs.
28. Interjected leaflets 3-4 pairs .... 69. *S. marinasense*
28. Interjected leaflets 5-6 pairs.
29. Plants low, 10-35 cm tall .... 48. *S. ancoripae*
29. Plants of medium height, 36-70 cm tall .... 82. *S. sparsipilum*
26. Flowers much larger, 3.5 cm or more in dia.
30. Flowers 3.5-4.0 cm in dia.
31. Interjected leaflets 0-2 pairs.
32. Calyx medium-sized, 6-8 mm long.
33. Terminal leaflet slightly larger than the laterals .... 88. *S. velardei*
33. Terminal leaflet much larger than the laterals .... 73. *S.* × *neoweberbaueri*

32. Calyx large, 9-10 mm long .... 83. *S. tacnaense*

31. Interjected leaflets more than 2 pairs.

34. Interjected leaflets 5-6 pairs.

35. Plants of medium height, 35-70cm tall .... 74. *S. orophilum*

35. Plants low, 10-35 cm tall .... 75. *S. pampasense*

34. Interjected leaflets 7 pairs or more.

36. Leaves sparsely pilose .. 55. *S. candolleanum*

36. Leaves pilose .... 46. *S. ambosinum*

30. Flowers very large, 4 cm or more in dia .... 72. *S. multiinterruptum*

24. Flowers lilac, violet or purple.

37. Corolla lilac.

38. Corolla medium-sized, 2.7-3.0 cm in dia. .... 68. *S. lopez-camarenae*

38. Corolla larger, greater than 3 cm in dia.

39. Corolla large, 3.5-4.0 cm in dia. .... 49. *S.* × *arahuayum*

39. Corolla very large, more than 4 cm in dia. .... 65. *S. incasicum*

37. Corolla violet, indigo-blue, or purple

40. Corolla violet, flowers small, 2.0-2.5 cm in dia. .... 84. *S. tapojense*

40. Corolla indigo-blue or purple, larger than 2.5 cm in dia.

41. Flowers indigo-blue.

42. Flowers 2.7-3.0 cm in dia., medium-sized

43. Interjected leaflets 0-2 pairs.

44. Lateral leaflets 0-2 pairs .... 61. *S. huancavelicae*

44. Lateral leaflets 3-4 pairs.

45. Pedicels articulated in the upper one-third of their length .... 83a. *S. tacnaense* f. *decurrentialatum*

45. Pedicels articulated near or above center ... 76. *S. puchupuchense*

43. Interjected leaflets 3-4 pairs.

46. Pedicels articulated near base of calyx .. .. 80. *S. saxatilis*

46. Pedicels articulated near the midpoint .. .. 52. *S. bill-hookeri*
42. Flowers large, 3.5-4.0 cm in dia. .... 44. *S. acroscopicum*
41. Corolla purple.
    47. Corolla small, 2.0-2.5 cm in dia. .... 86. *S. taulisense*
    47. Corolla much larger, 2.5 cm or more in dia.
        48. Corolla medium-sized, 2.7-3.0 cm in dia.
            49. Interjected leaflets 0-2 pairs.
                50. Pedicels articulated in the upper one-third of their length .... 81. *S. scabrifolium*
                50. Pedicels articulated near the base of the calyx.
                    51. Leaves sparsely pilose .... 77. *S. sandemanii*
                    51. Leaves pilose .... 70a. *S. medians* var. *autumnale*
            49. Interjected leaflets more than 2 pairs.
                52. Interjected leaflets 3-4 pairs .... 79. *S. sawyeri*
                52. Interjected leaflets 7 or more pairs .... 87. *S. trinitense*
        48. Corolla large, 3-4 cm in dia. .... 70. *S. medians*

44. *Solanum acroscopicum* Ochoa, Agronomía, Lima, 18(74):130-132, illustr., 1953. Fig. 213-216; Map 19.

Plant erect, 30-50(-70) cm tall, glabrous or glabrescent to sparsely pilose; stem simple or little-branched, 5-8 mm in dia. at the base, slightly flexuous, glabrous, pale green to slightly pigmented along the basal one-third of its length, narrowly straight winged; internodes (2.0-)3.5-7.0 cm long. Stolons to 80 or more cm long and 1.5-2.0 mm in dia., white; tubers white, long-cylindrical or subcylindrical, straight to subfalcate or falcate, large, 5-8 cm long by 2.5-3.0 cm in dia. with many deep eyes (Fig. 215). Leaves imparipinnate, (9.5-)12.0-22.5(-29.0) cm long by (5.0-)8.5-18.5(-20.5) cm wide, with very short scattered hairs above, less pilose below, with 4-5 pairs of lateral leaflets and 4-8 pairs of interjected leaflets,

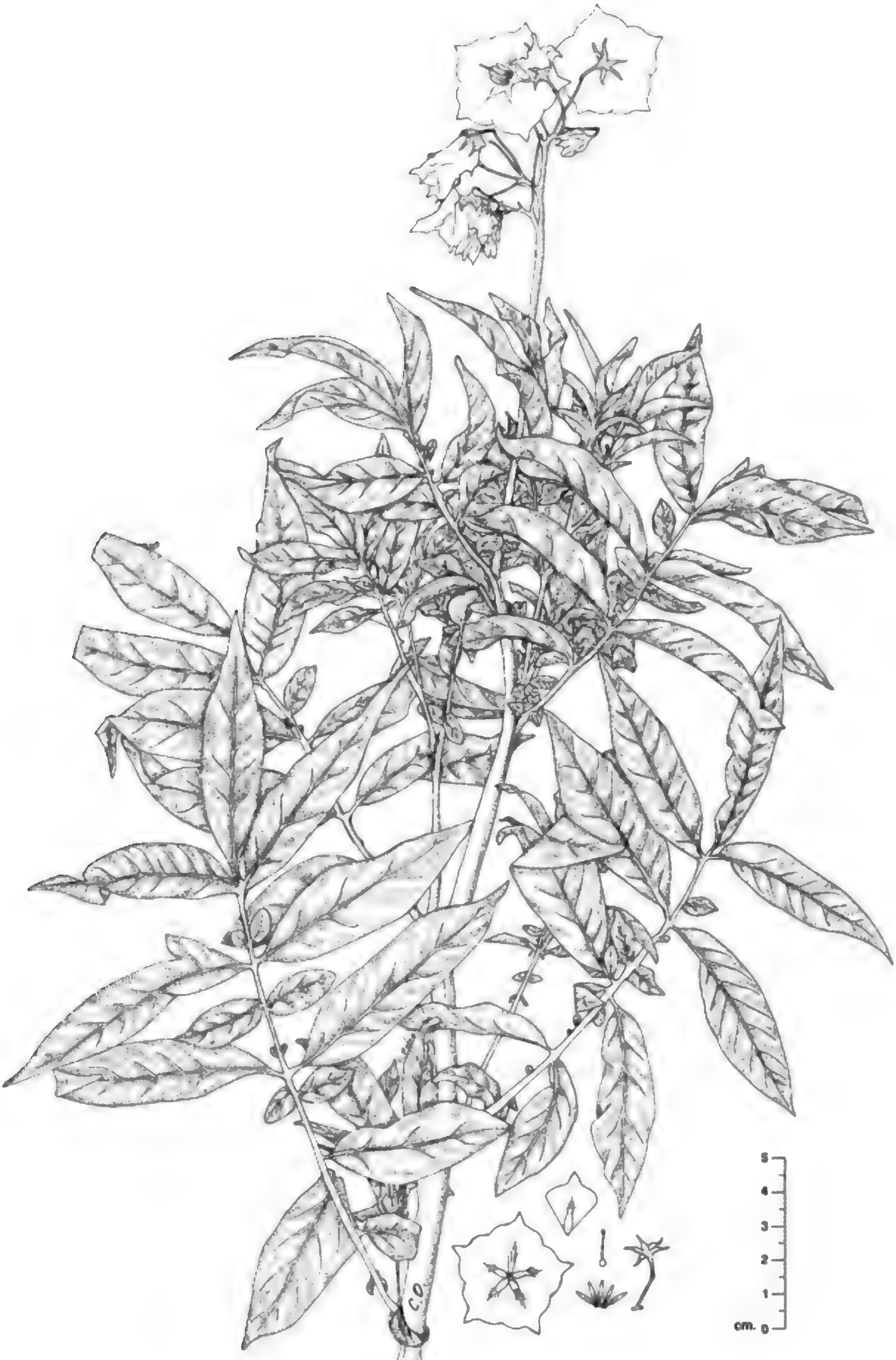


Figure 213. *Solanum acroscopicum* (*Ochoa 5108*).

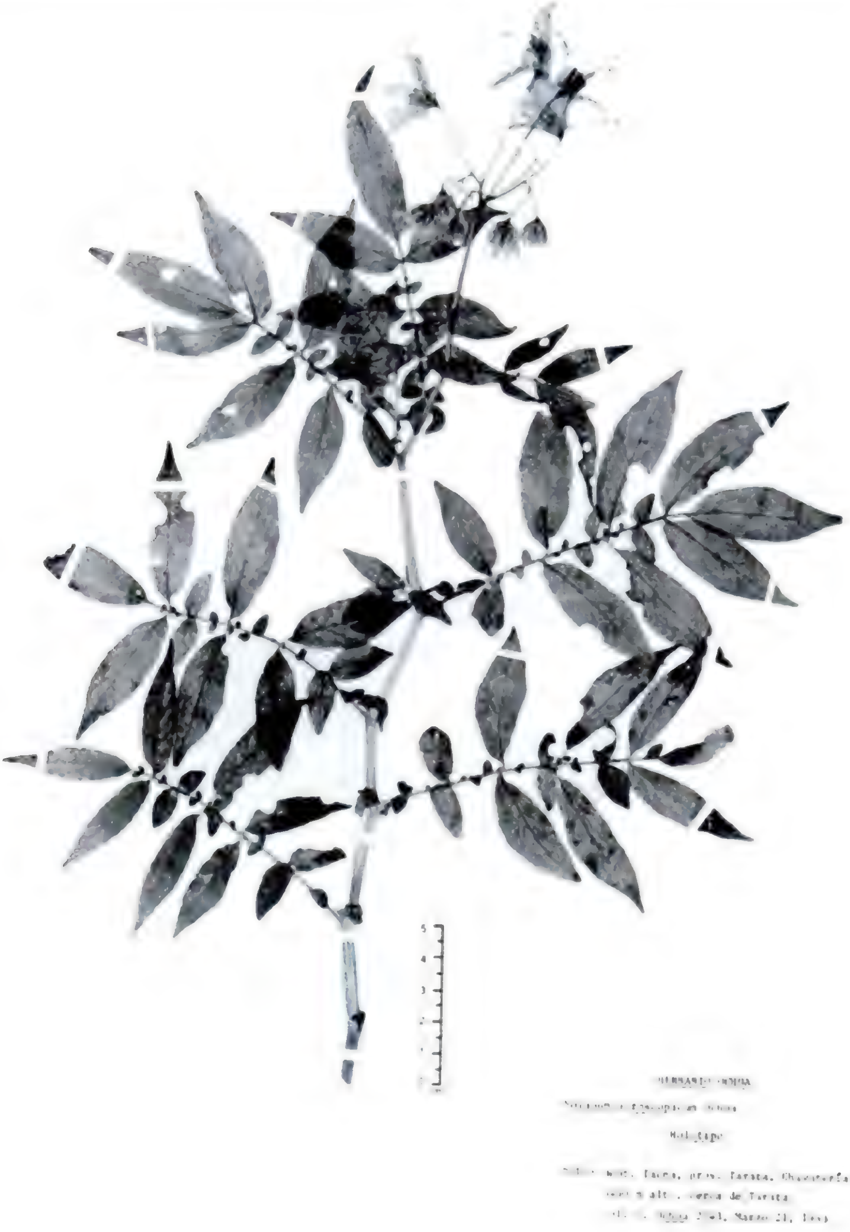


Figure 214. *Solanum acroscopicum* (*Ochoa 2043* holotype).

these at times disposed acroscopically or basiscopically, usually between the second and third upper pair but nearly always with the occurrence of a pair of acroscopic segments on the first upper pair of the lower leaves. Lateral leaflets narrowly lanceolate, the apex long-acuminate or narrowly pointed, base oblique or narrowly rounded and shortly petiolulate, petiolules 1.0-2.5(-5.0) mm long. Terminal leaflet (5.0-)6.0-9.0 cm long by (1.5-)1.8-2.0 cm wide, base rounded or cuneate, nearly the same size as the first pair of lateral leaflets, leaflets of the second upper pair slightly larger than the those of the first pair. Interjected leaflets of different size, 1-20 mm long, orbicular, ovate or elliptical, sessile. Pseudostipular leaves broadly lunate and clasping, to 20 mm long by 8-9 mm wide. Inflorescence terminal and lateral, cymose-paniculate, 10-20-flowered; peduncle glabrous, light green, vigorous, (5)10-12 cm long by 3 mm in dia. at the base; pedicels glabrous, slender, slightly pigmented, 15-25(-40) mm long, articulated about 3-4 mm below the base of the calyx. Calyx usually symmetrical, 7-8 mm long, light green, glabrous; lobes broadly ovate membranous abruptly acuminate, acumens narrowly pointed, linear, 2-4(-7) mm long. Corolla rotate or broadly rotate-pentagonal, large, 3-4 cm in dia. (Fig. 213), pale violet to purple-violet. Anthers narrowly lanceolate, 5.5-6.5 mm long, base cordate; filaments glabrous, 1.5-2.0 mm long, white-hyalinous or occasionally slightly lilac-tinted along the upper one-third of their length or near the base of the anthers. Style 10.5-11.5 mm long, exerted 2.5-4.0 mm, densely papillose below center; stigma capitate, small. Fruits 1.5-2.0 cm in dia., globose to ovoid, light green, marked with scattered white dots, not verrucose. Chromosome Number: 2n=24.

Type: PERU. Department Tacna, Province Tarata, Chivatería, 3450 m alt., above Tarata, in thickets in loose, damp soils, 22 March 1953, C. *Ochoa 2043* (OCH holotype; GH, US, isotypes).

Affinities

Solanum acroscopicum shares certain features in common with *S. santolallae*, including elliptic-lanceolate leaves that terminate in an attenuate, pointed or acuminate tip. Also, both plants are either entirely glabrous or are covered with very short, scattered hairs.

Habitat and Distribution

Unlike *S. santolallae*, which thrives in moist, warm, subtropical or tropical forest areas, *S. acroscopicum* is a species of the high mountain areas of Peru. It grows preferentially in high, narrow quebradas at elevations ranging between

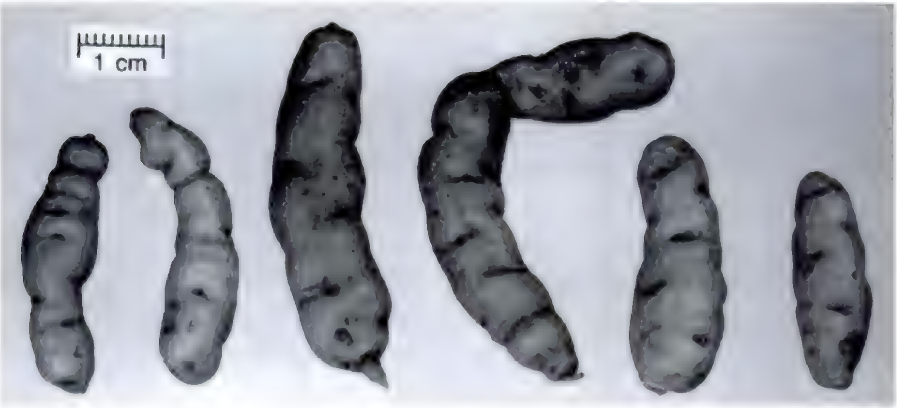


Figure 215. Tubers of *Solanum acroscopicum.*

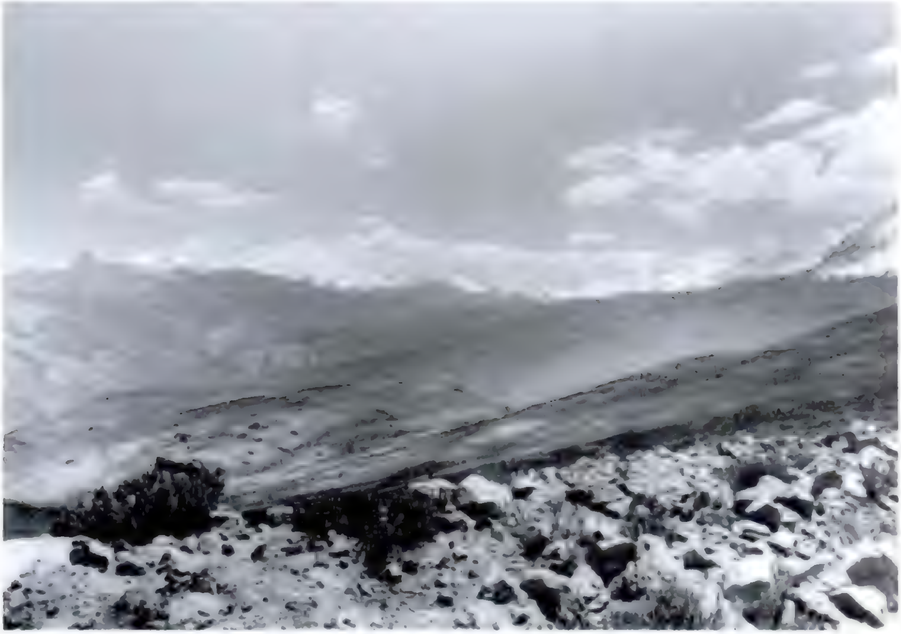


Figure 216. Foreground: Habitat of *S. acroscopicum*, between 3400 and 3700 m alt. Background: Cordillera de Tacna. Photo: C. Ochoa, March 1981.

3000 and 3900 m, or on slopes or rocky hillsides covered with *prepuna* or *puna* vegetation. It is also found on moist talus slopes near irrigation ditches. Geographically, this species ranges through portions of the Departments of Ayacucho, Arequipa, Moquegua and Tacna, or from $14^{o}42'$ S and $74^{O}08'$ W to $17^{o}28'$ S and $70^{O}02'$ W (see Map 19).

Specimens Examined

Department Arequipa

Province Arequipa: Cabrerías-Chachani, 3600-3700 m alt., in damp shady places, flowers purplish-blue, 11 May 1973, *G. Arenas 144* (USM). Between the Poroto River and Puquina, 3350 m alt., on rocky slopes, 21 April 1967, C. *Vargas C. 19346* (OCH-two sheets, CUZ).

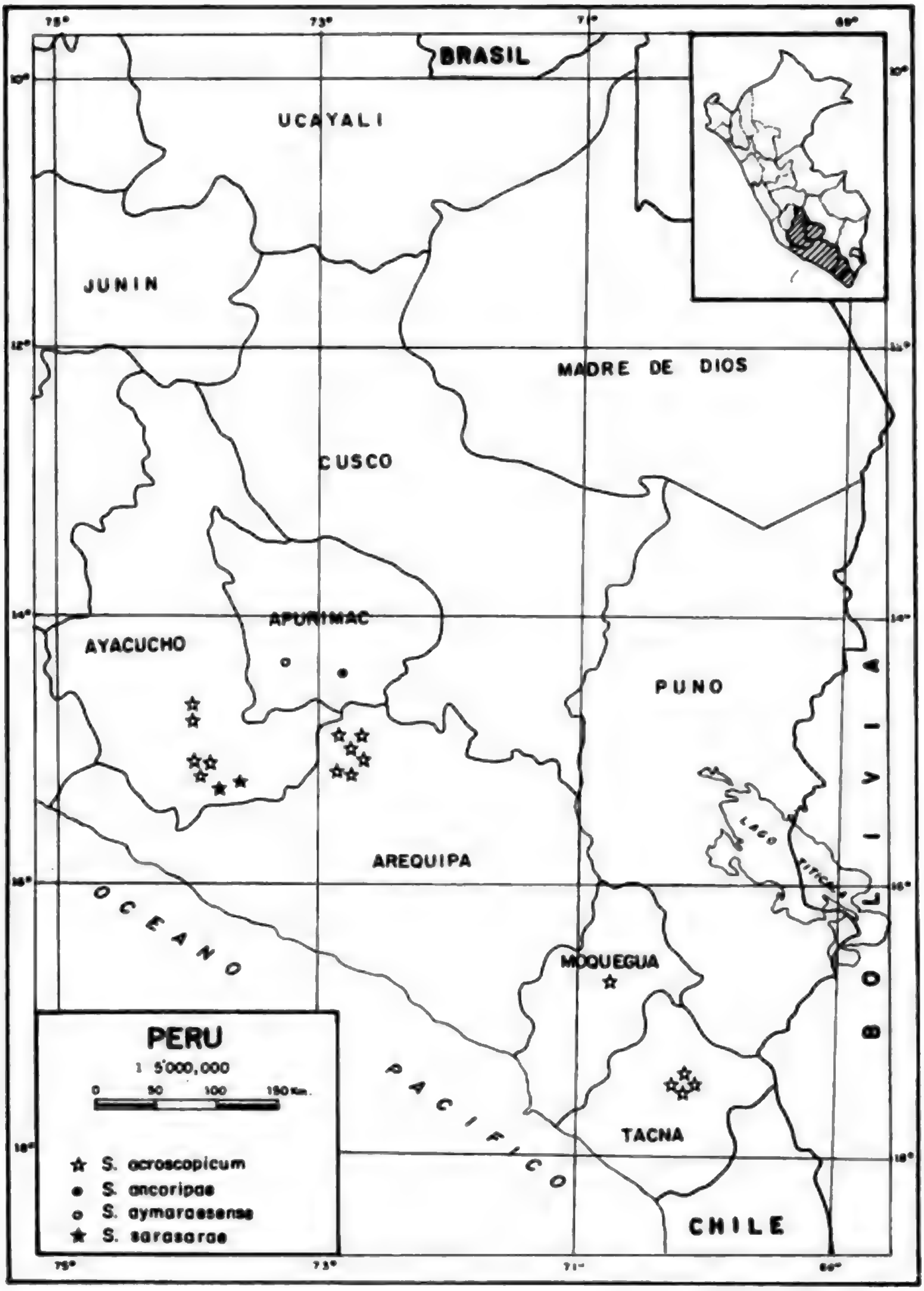
Province Condesuyos: Bodegayoc, 3500 m alt., along the route Chuquibamba-Cotahuasi, 31 March 1974, C. *Ochoa 5108* (CIP, GH, MOL, OCH). Cabracancha, 3200 m alt., 23 April 1967, C. *Vargas* C. *19425* (CUZ).

Province La Unión:Ayachani, 3000 m alt., above Cotahuasi, March 1963, C. *Ochoa S-86*, 2n=24 (OCH, from plants grown at Sturgeon Bay, Wis., U.S.A.). Chajcho, *ca*. 3200 m, near Allpa Jaspina, about 10 km above Cotahuasi, March 1963, C. *Ochoa 2446* (GH, MO, MOL, OCH). Huambo, 3200 m alt., near Cotahuasi, March 1963, C. *Ochoa S-81*, 2n=24 (OCH, from plants grown at Sturgeon Bay, Wis., U.S.A.). Ayachani, ca. 3200 m alt., in gravel soil on slopes, in full fruit, berries round to ovoid, densely marked with white dots, May 1973, C. *Ochoa 3617* (OCH). Pitahuasi, ca. 3250 m alt., plants in full fruit, berries ovoid to round, densely spotted with small white dots, not verrucose, May 1973, C. *Ochoa 3618*, 2n=24 (MO, OCH). District Cotahuasi, Ancoylla, ca. 3300 m alt., past flowering but in full fruit, berries round, May 1973, C. *Ochoa 3619*, 2n=24 (OCH). District Cotahuasi, above Huambo, 3250 m alt., berries abundant, round, green marked with white dots, May 1973, C. *Ochoa 3620* (OCH). Hillsides near Cotahuasi, 3400-3750 m alt., in scattered thickets. April 25, 1967; C. *Vargas C. 19500* (CUZ, OCH).

Department Ayacucho

Province Lucanas: Latacc, 3500 m alt., along the route Puquio-Chalhuanca, 15-20 March 1972, C. *Ochoa 3265* and *3266* (OCH).

Province Parinacochas: Highlands of Oyolo, 3800 m alt., 15-20 April 1971, C. *Ochoa* and A. *Salas 3004* (CIP, OCH). District Chumpi, Cerro Anoccacca, 3700-3900 m alt., 15 March 1972, C. *Ochoa and A. Salas 3253* (CIP, MO, MOL, OCH). District Chumpi, on rocky slopes of Cerro Anoccacca, 3800 m alt., March 1984, C. *Ochoa 15367*, 2n=24 (CIP, GH, OCH). Pampas de Oyolo, 3300-3500 m alt., March 1984, C. *Ochoa 15371* (OCH). Between Oyolo and Pausa, 3550 m alt., much before the crossing of the Huanca River, March 1984, C. *Ochoa 15372* (OCH). Between Oyolo and Colta, 3600 m alt., before the crossing of the Pastopampa River, March 1984, C. *Ochoa 15373* (OCH). Above Pacapausa, 3650 m alt., March 1984, C. *Ochoa 15378* (OCH).



Map 19. Distribution of *S. acroscopicum, S. ancoripae, S. aymaraesense* and *S. sarasarae.*

Department Moquegua

Province Mariscal Nieto: Carumas, 3200 m alt., "Rainy-green formation. Tuberous. Flowers light-violet." February 21-March 6, 1925; *A. Weberbauer 7304* (LL).

Department Tacna

Province Tarata: Chivatería, 3450 m alt., near Tarata, on moist talus slopes and along the edges of irrigation ditches, 22 March 1953, *C. Ochoa 2043* (holotype OCH, isotypes GH, US). Saillani, 3350 m alt., above Tarata, 27 March 1963, *C. Ochoa 2467* (OCH). Umulsho, 3300 m alt., near Tarata, on rocky and very dry soils, 27 March 1963, *C. Ochoa 2468* (OCH). Chivatería, 3450 m alt., highlands of Tarata along the route to Puno, 10 April 1973, *C. Ochoa 3609* (topotype OCH). District Tarata, Irabalaco, 3100 m alt., along the edges of irrigation ditches and among large rocks, 10 April 1973, *C. Ochoa 3610* (GH, OCH). District Tarata, between Irabalaco and Chivatería, 3200 m alt., in moist stony soil, and along the edges of irrigation ditches, 10 April 1973, *C. Ochoa 3611*, 2n=24 (OCH).

45. ***Solanum amayanum*** Ochoa, Am. Potato J. 66:1-4, illustr., 1989.

Figs. 217-219; Map 20; Plate XXII.

Plant erect, (20)-30-40(-50) cm tall; stem light green, (3-)4-8 mm in dia. at the base, narrowly winged, usually simple, very pubescent, hairs multicellular, silvery-white, unequally 2-5 mm long, internodes (1.5-)2.5-5.5(-7.0) cm long. Stolons to 1 m or more long, 1.5-3.0 mm in dia., milky-white; tubers round to ovoid, 2-4 cm long, white, conspicuously lenticulate. Leaves (7.0-)11.0-17.5 (-21.0) cm long by (3.0-)5.0-8.5(-11.5) cm wide, imparipinnate, with (2-)3-4(-5) pairs of leaflets and 2-5(-9) pairs of sessile interjected leaflets, dark green and pubescent above, including the rachis, the petioles and the upper surface of the petiolules; lighter green and somewhat more densely pubescent below, including the veins, the veinlets and mesophyll. Terminal leaflet slightly larger to much larger than the lateral leaflets, (4.5-)7.0-10.0(-11.5) cm long by (1.8-)3.0-5.5 (-6.0) cm wide, elliptic-lanceolate to rhombic-lanceolate, apex pointed to subobtuse, base cuneate or occasionally obtusely rounded; leaflets of the first upper pair (1.0-)2.0-5.0(-6.5) cm long by (0.5-)1.0-1.5(-2.5) cm wide, apex pointed to subobtuse, base obliquely rounded, sessile or subsessile, or very narrowly decurrent about the rachis; the remaining lateral leaflets abruptly diminishing in size toward the base of the leaf, the last pair of the lowermost leaf being considerably smaller. Interjected leaflets of two or three different sizes, from 1 to 5 mm long,

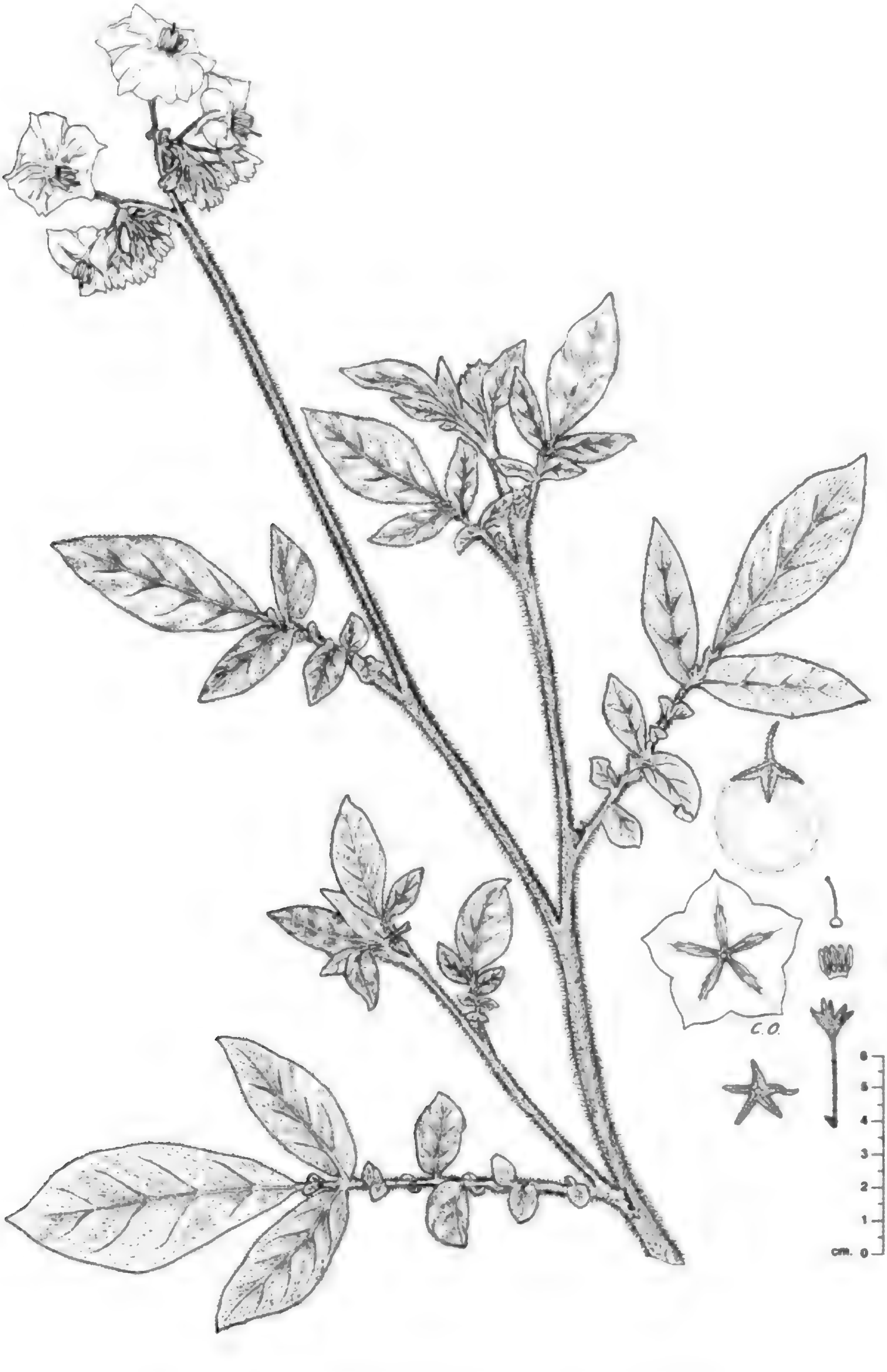


Figure 217. *Solanum amayanum* (*Ochoa* 4299, holotype).

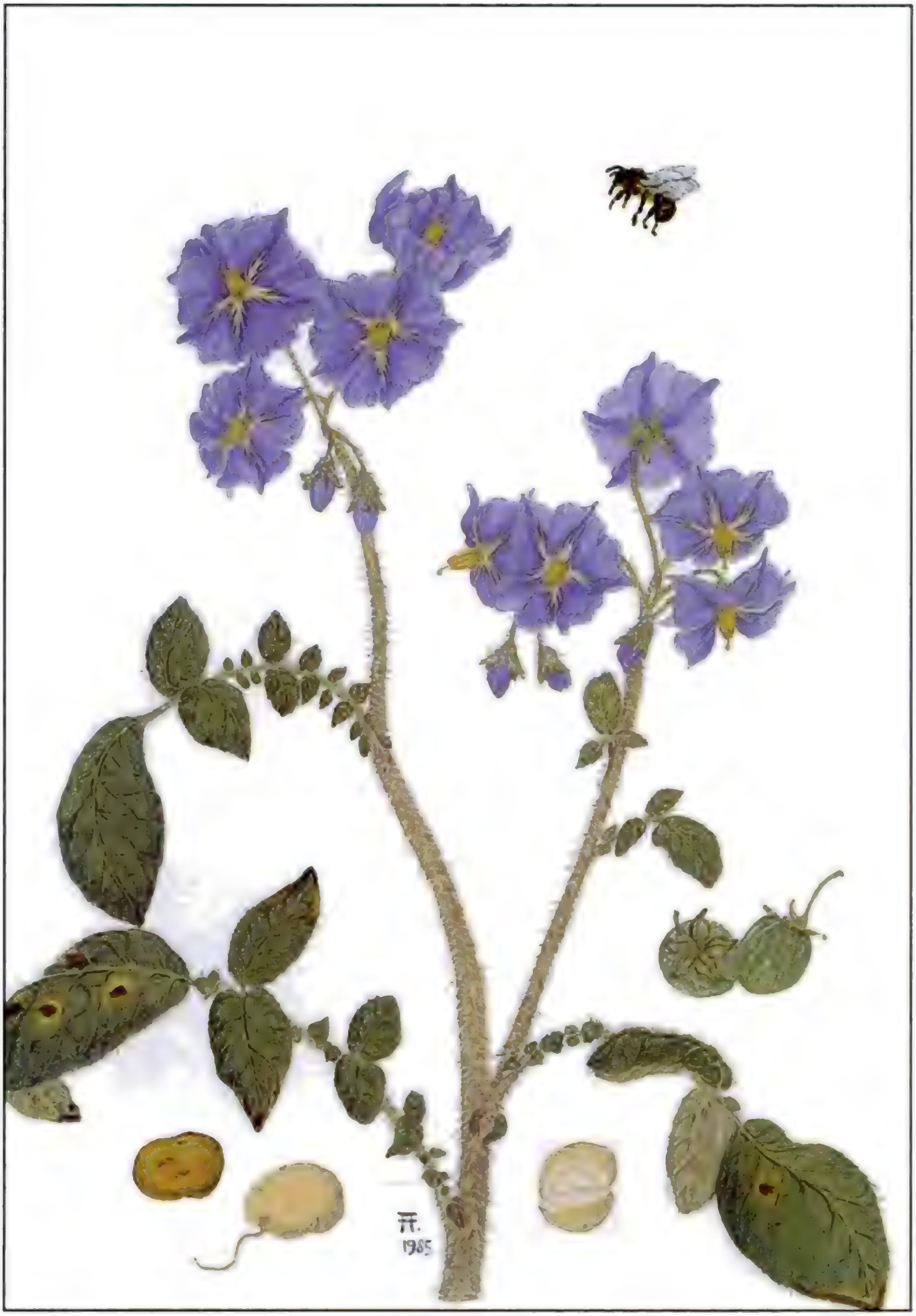


Plate XXII. *Solanum amayanum* Ochoa.

orbicular to ovate, sessile or decurrent. Pseudostipular leaves narrowly falcate, usually small, 4-5 mm long, rarely to 12 mm long. Inflorescence cymose, with 10-15 flowers; peduncle up to 15 cm long by 2.0-2.5 mm in dia at base, pubescent, hairs simple, 1-2 mm long, mixed with shorter glandular and tetralobular hairs; pedicels 15-25 mm long, pilose, articulated 6-8 mm below the base of the calyx. Calyx pilose, symmetrical, 8-10 mm long; lobes unequally long, usually rectangular-cornered, narrowed at the apex, the acumens unequally long and broadly sub-pointed to obtusely subspatulate, 2-4 mm long. Corolla rotate-pentagonal or rotate, large, 3.5-4.0 cm in dia. (Figs. 217, 218), purple to dark purple, internal star yellowish-green, acumens whitish on the outside, the margins densely pubescent, the external side sparsely and partially pilose, hairs very short and fine. Anthers narrowly lanceolate, 5.5-6.5 mm long, base cordate; filaments 1.0-1.5 mm long, white, glabrous. Style 10-12 mm long, exerted 2-3 mm, papillose below center; stigma subclaviform, small and cleft. Fruit round, 1.5-2.0 cm in dia. Chromosome Number: 2n=24. EBN=2.

Type: PERU. Department Huancavelica, Province Tayacaja, near Cerro Chihuanjaja, ca. 3550 m alt., on steep and rocky slopes, March 1973, *C. Ochoa 4299* (holotype OCH, isotypes F, GH, MOL, USM, US). Paratype: PERU. Department Huancavelica, Province Tayacaja, near Huancayojaja, along the route Colcabamba-Huancayojaja, *ca.* 3000 m alt., January 1985, *C. Ochoa and J. Amaya 15910* (CIP, F, MOL, OCH, UNTC, US, USM).

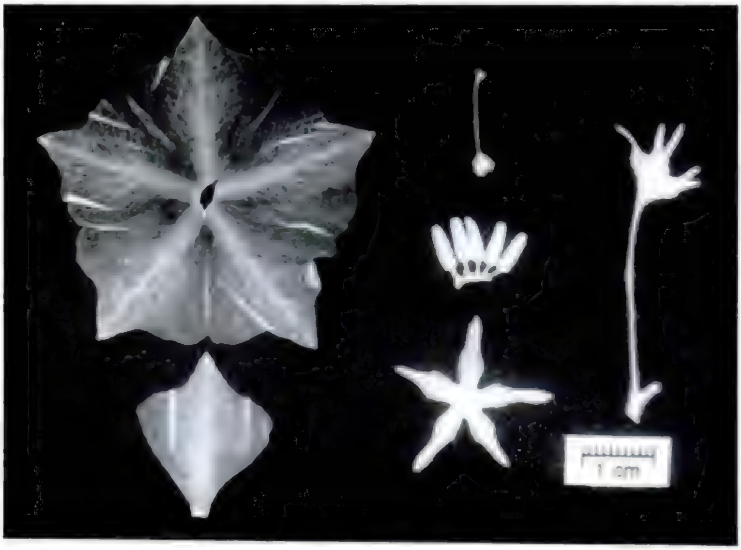


Figure 218. Floral dissection of *Solanum amayanum* (*Ochoa* 4299, holotype).

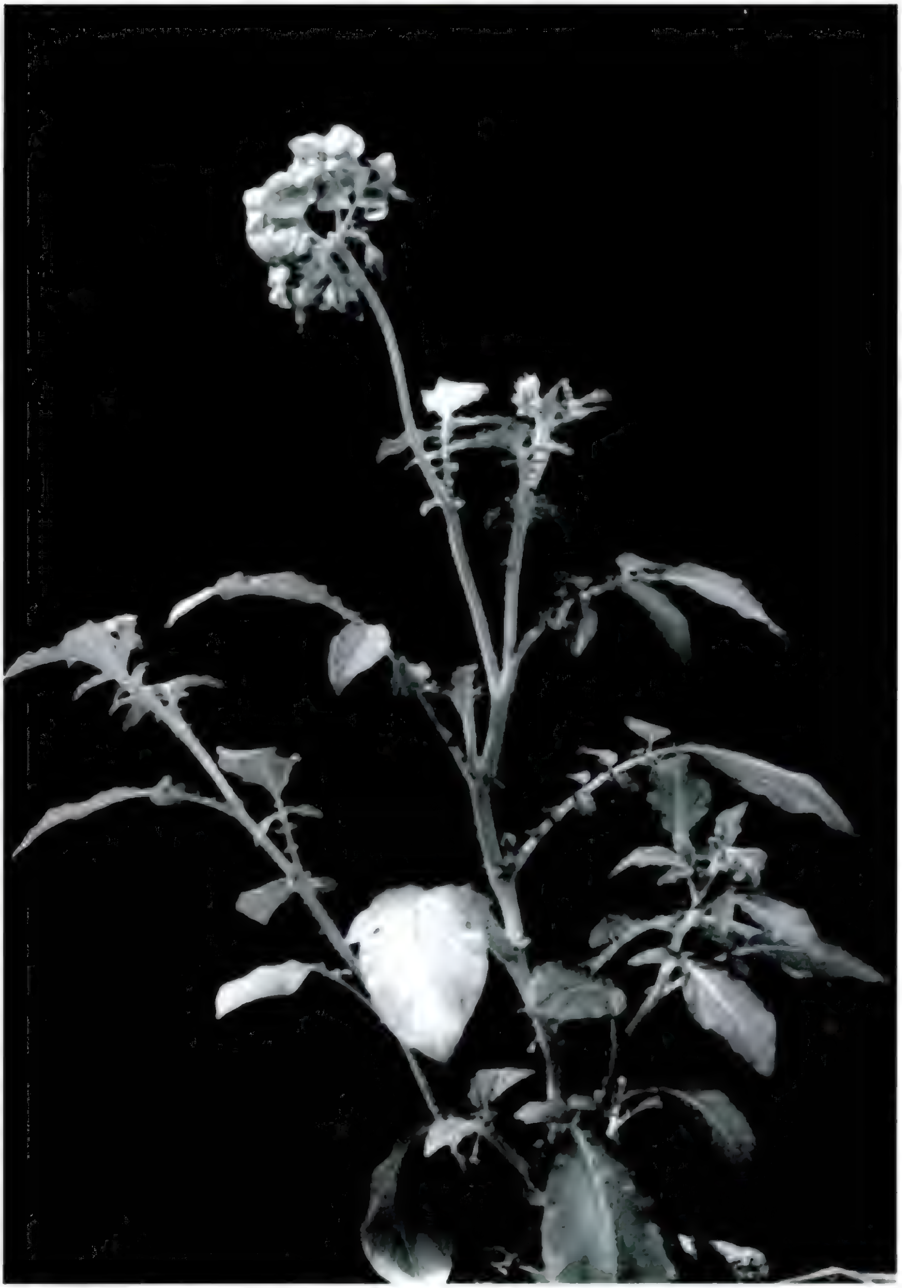


Figure 219. Plant of *Solanum amayanum* in its habitat at the type locality (*Ochoa* 4299, holotype).

To better understand the variance in the isotype and paratype collections of *S. amayanum*, the author recently made additional collections of this species at its type locality. In two of the more recent collections of *S. amayanum* (*Ochoa 16261* and *16263*), the plants were observed to be less pubescent, especially on the lower side of the leaves. Moreover, aside from being moderately pilose, the plants were rather small and ranged from bushy to slightly rosette-forming at base. As in the type collection, there was also much variability in the shape of the corolla, this varying from rotate (No. *16263*) to rotate-pentagonal (No. *16265*) as in the holotype.

Affinities

Solanum amayanum and *S. medians* var. *autumnale* have some characteristics in common, including the size and shape of the terminal leaflet, the density of the pubescence on the calyx and floral buds and corolla shape and color. The two species, however, are geographically quite distant from one another, and grow in entirely different habitats.

On the other hand, a much closer relationship would appear to exist between this species and *S. bukasovii*. Both occur in high mountain habitats, and both are similar in plant habit, size and shape of the corolla and fruit shape. They differ from one another primarily in the relative size and shape of the terminal leaflet, calyx, point of articulation of the pedicel and in the nature of the indumentum.

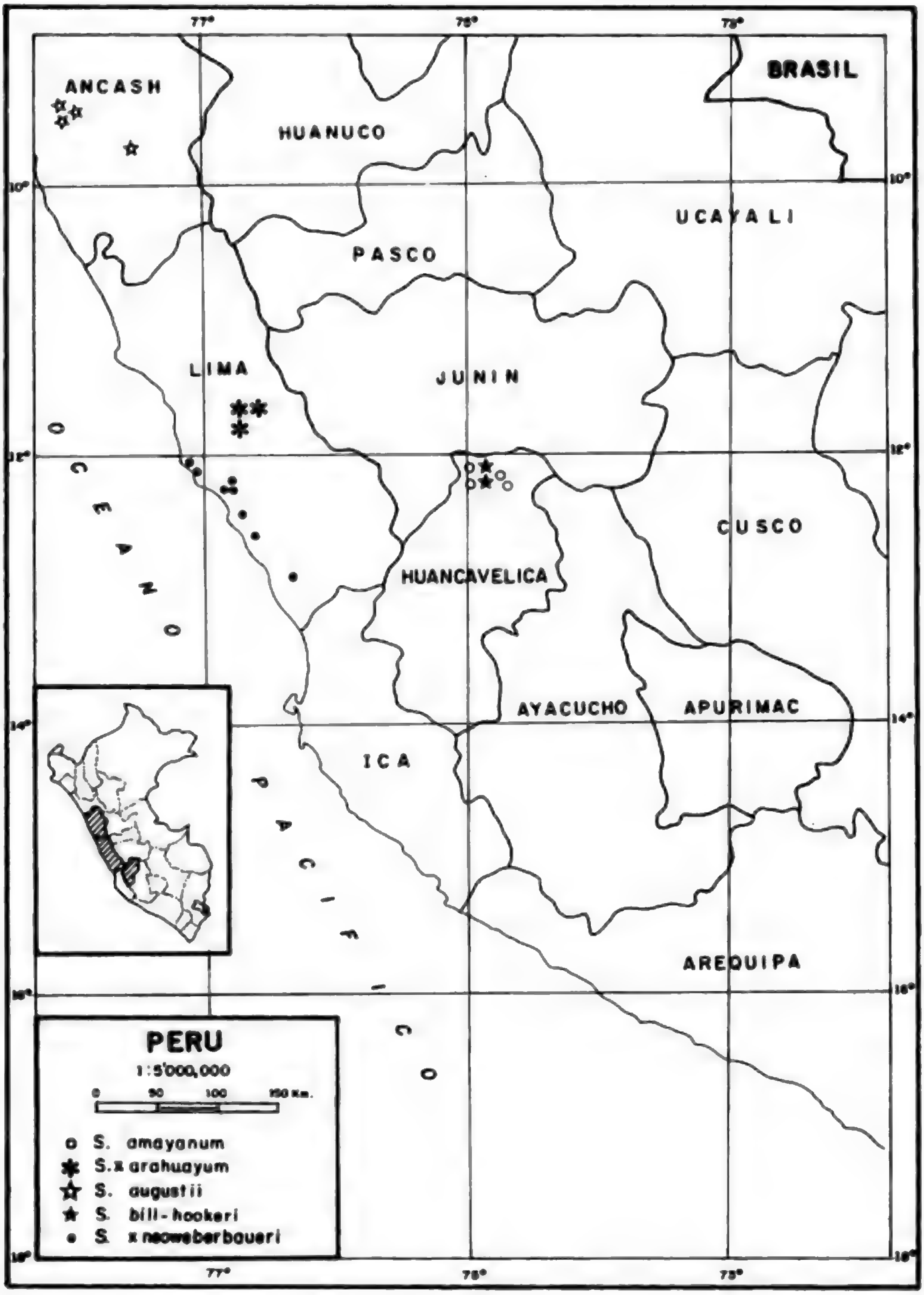
Habitat and Distribution

Solanum amayanum grows in the native steppes or grasslands of *Stipa ichu* that characterizes the *puna* or *prepuna* formations of central Peru. It is found largely on high, cool, rocky slopes and scarps at elevations ranging from 3000 to 3900 m. Presently, this species is known only from the Province of Tayacaja in the Department of Huancavelica (Map 20).

Specimens Examined

Department Huancavelica

Province Tayacaja: On steep and rocky escarpments of Cerro Chihuanjaja, *ca*. 3550 m alt., March 1973, *C. Ochoa 4299* (F, GH, MOL, OCH, US, USM, type collection of *S. amayanum*). Near Huancayojaja, *ca*. 3000 m alt., along the route Colcabamba-Huancayojaja, January 1985, *C. Ochoa and J. Amaya 15910* (paratypes CIP, F, MOL, OCH, UNTC, US, USM) and (CIP, OCH, from plants grown in the greenhouse at Huancayo). Above Arhuayacu, District Colcabamba,



Map 20. Distribution of *S. amayanum*, *S.* × *arahuayum*, *S. augustii*, *S. bill-hookerii* and *S.* × *neoweberbaueri*.

3300 m alt., on rocky slopes, amid plants of *Lupinus, Salvia, Stipa* and *Oxalis* sp., 26 March 1996, *C. Ochoa and A. Salas 16261* (CIP fragments, OCH). Malpaso, 3900 m alt., between Carpapata and the road detour to Cobriza, among rock formations with *Stipa ichu*, 27 March 1996, *C. Ochoa and A. Salas 16263* (CIP, OCH, MOL, USM). Malpaso, 3750 m alt., among rocks, 27 March 1996, *C. Ochoa and A. Salas 16265* (CIP, MOL, OCH, USM).

Breeding Potential

Viable seeds were obtained in crosses of *S. amayanum 4299* with *S. bukasovii 14381, 14407* and *15304* only when *S. amayanum* was used as the staminate parent. However, yields were high, averaging as much as 114 seeds per berry. Unilateral crosses with *S. coelestispetalum 13605* and *S. marinasense 13722* were totally unsuccessful, even though both are diploid members of Series Tuberosa, and, like *S. amayanum*, have an EBN value of 2.

46. *Solanum ambosinum* Ochoa, Biota, Lima 1:6-9, illustr., 1954.

Figs. 220-225; Map 21; Plate XXIII.

Plant vigorous, erect to erect-ascending, (30-)60-80 cm tall, more or less pilose; stem robust 8-10 mm in dia. at the base, slightly pigmented in the basal one-third of its length and in the leaf axils, branched, sparsely and shortly pilose, narrowly straight winged or somewhat sinuous; internodes (1.5-)2.5-4.5(-6.0) cm long. Stolons 90-120 cm long, white, irregularly thickened and fleshy, 2-5 mm in dia.; tubers white, round to ovoid to long-cylindrical, large, (4-)6-8 cm long, the ends obtuse (Fig. 223). Leaves (7.5-)11.0-23.5(-32.0) cm long by (4.0-)7.0-12.5(-19.0) cm wide, dark green and pubescent, hairs silvery-white brilliant above, pale grayish-green and somewhat more densely pubescent below, imparipinnate, with 4-5 pairs of lateral leaflets and 7-11(-15) pairs of sessile interjected leaflets of various size. Leaflets elliptic to ovate-elliptic or broadly elliptic-lanceolate, the apex obtuse and pointed or shortly acuminate, base symmetric to oblique and broadly rounded or cordate to subtruncate on petiolules 1 mm to 10 mm or more long. Terminal leaflet nearly the same size as the first and second pairs of lateral leaflets, varying from (3.5-)5.0-10.0 cm long to (2.0-)3.0-4.5 cm wide; leaflets of the lowermost pairs considerably smaller than the previous ones, 5-15 mm long, ovate, elliptical or suborbicular and sessile. Pseudostipular leaves broadly falcate, 7-15 mm long by 4-8 mm wide. Inflorescence terminal or lateral, cymose or cymose-paniculate with (4-)10-20 flowers; peduncle robust, (4-)7-12 cm long and 2-3 mm in dia., forked two or three times, pigmented, sparsely and finely

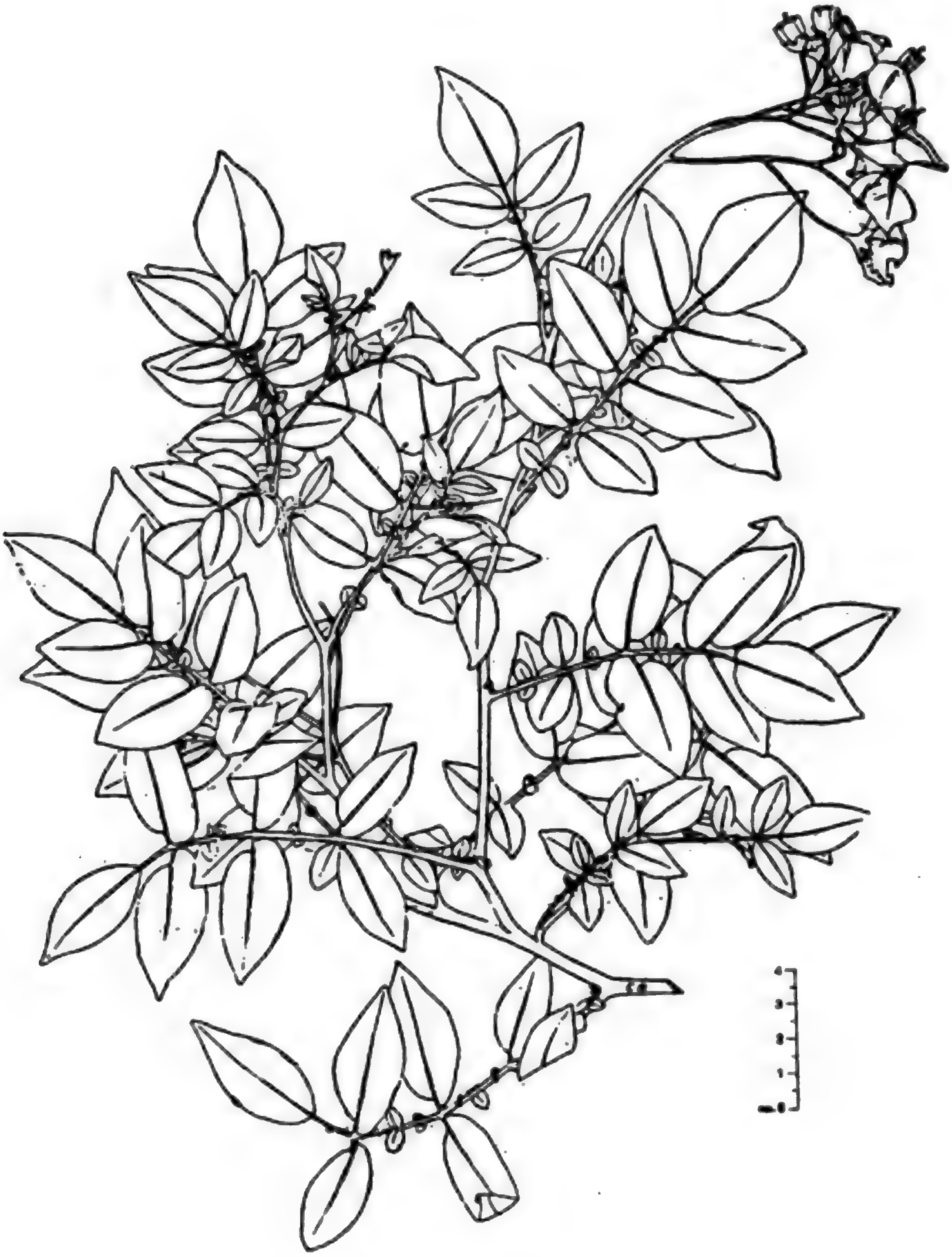


Figure 220. *Solanum ambosinum* (*Ochoa 1040*, holotype).

pilose; pedicels pilose, slender, 15-35(-45) mm long, articulated near or high above the midpoint or about 9-12(-14) mm below the calyx. Calyx symmetrical, 7-10 mm long, slightly pigmented, pilose; lobes ovate-lanceolate, narrowed to the pointed or subspatulate acumens, short, 1.5-2.5 mm long. Corolla purple-violet or blue-violet, rotate, 3.0-3.5(-4.0) cm in dia., acumens short (Fig. 221), the margins pubescent. Anthers lanceolate, 6 mm long, base cordate; filaments 1.0-1.5 mm long, glabrous. Style 9.5-10.5 mm long, exerted 3 mm, densely

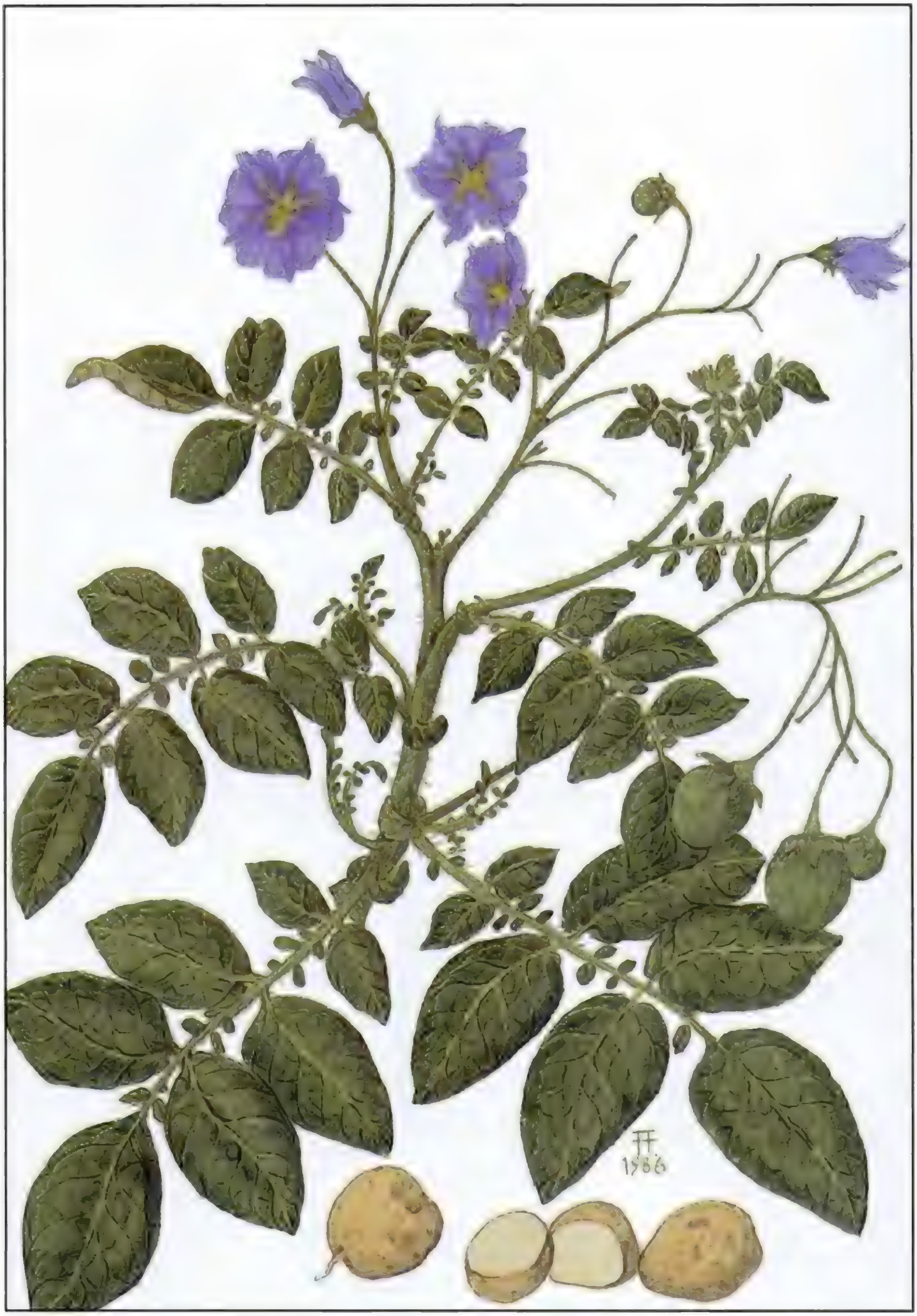


Plate XXIII. *Solanum ambosinum* Ochoa.

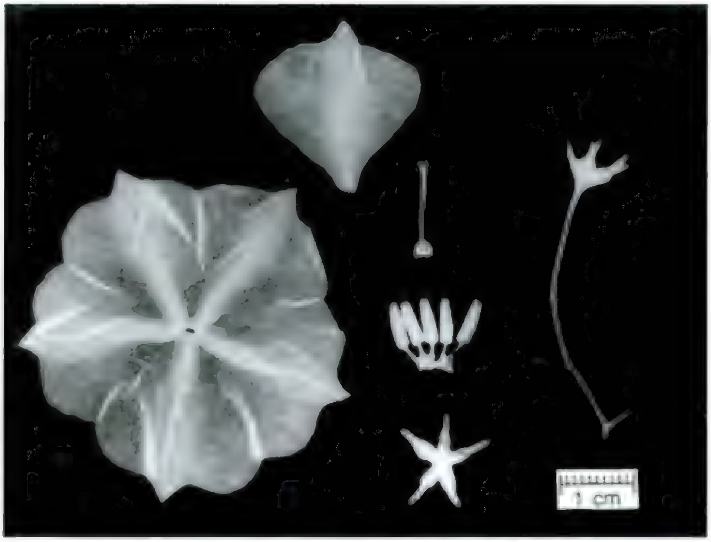


Figure 221. Floral dissection of *Solanum ambosinum* (*Ochoa 14557*), plant collected from near the type locality.

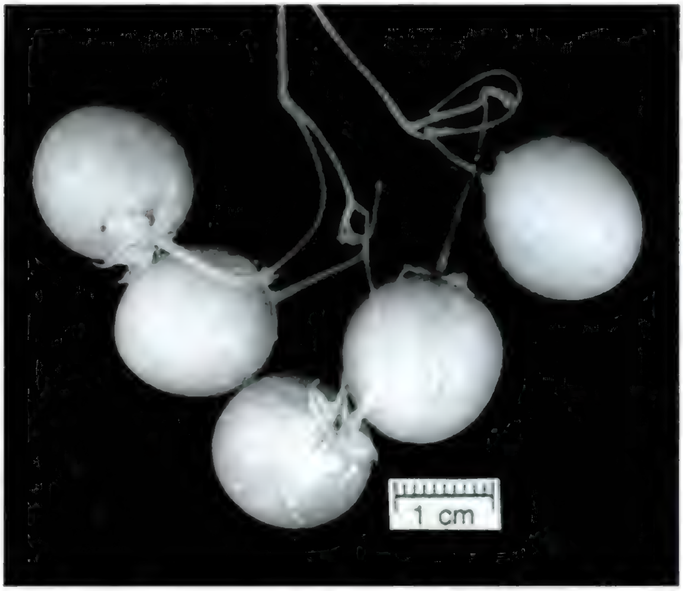


Figure 222. Fruits of *Solanum ambosinum* (*Ochoa 14605*).

papillose along the lower two-thirds of its length; stigma globose, cleft, small. Fruit globose, green with scattered white dots, not verrucose, 1.5-2.0 cm in dia. (Fif. 222). Chromosome Number: 2n=24. EBN=2.

Local Names: *Auquillo papa* (= Grandfather Potato) in Jircán, Huánuco, and *Purum papa* (= Wild Potato, *i.e.* grows in untilled land) in Sillapata, Daniel A. Carrión, Pasco.

Type: PERU. Department Huánuco, Province Ambo, km 38 of the road Huánuco-Cerro de Pasco, between Ambo and San Rafael, 2200 m alt., 16 March 1951, C. *Ochoa 1040* (holotype OCH).

Affinities

Solanum ambosinum is related to *S. orophilum*. Both have large tubers and moderately dissected leaves, and both are similar in habit and pilosity. They differ principally by the respective shape of their leaflets.

Although obviously related to *S. orophilum*, this species also shows some features in common with *S. coelestispetalum*, as well as with *S. bukasovii*. For example, *S. ambosinum* and *S. coelestispetalum* are similar in pedicel articulation and in the habit, branching and vigor of the plant, and both are endowed

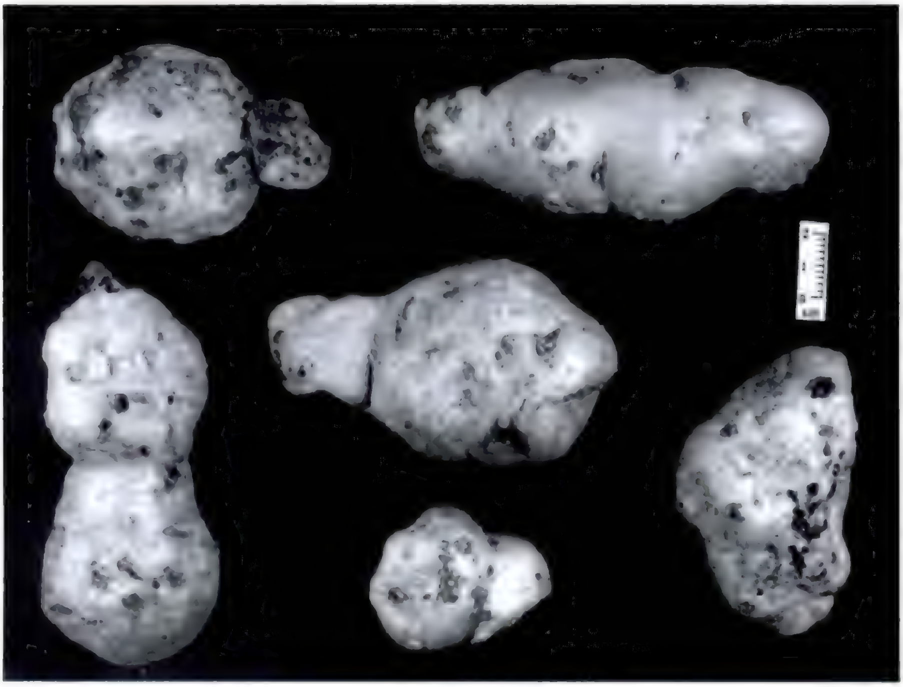


Figure 223. Tubers of *Solanum ambosinum* (*Ochoa 14557*).

with long, pilose peduncles and pedicels. They differ, however, with respect to overall density of pubescence, leaf dissection, calyx size and shape and corolla size and color.

Solanum bukasovii is similar to *S. ambosinum* in the overall pilosity of the plant and in having dark green, well-dissected leaves and a large corolla. However, it differs strongly from that species by the habit of the plant and in having a lower pedicel articulation and larger calyx.

That *S. ambosinum* has strong ties to the above species is again suggested by the fact that all three species are highly cross-compatible with *S. ambosinum*, and that large numbers of seeds are obtained in Unilateral crosses.

Habitat and Distribution

Although *S. ambosinum* has been occasionally collected in high, cold, *puna-type* habitats at elevations ranging between 3200 and 3600 m, it is more commonly found at lower elevations, generally between 2000 and 2900 m, where the climate is more temperate or benign. Thus, of the 36 collections of *S. ambosinum* that are cited in this work, 26 were originally collected from the drier, lower interandean valleys of Peru. Within these xerophytic to subxerophytic habitats, *S. ambosinum* grows in association with columnar or cylindrical cacti such as *Trichocereus* and *Espostoa*, trees of *Schinus molle* and *Caesalpinia spinosa*, and various other plants that are common to dry areas, such as *Agave americana*, *Fourcroya andina*, *Dodonea viscosa*, *Bromelia* and *Tillandsia* spp. It has also been reported to grow with plants of such herbaceous genera as *Ipomoea*, *Oxalis*, *Commelina*, *Lycopersicon*, *Sicyos*, *Crotalaria*, *Physalis* and *Datura*.

Solanum ambosinum is distributed in the Provinces of Aija, Bolognesi and Pallasca (Department of Ancash), the Provinces of Ambo, Dos de Mayo and Huamalíes (Department of Huánuco) and the Province of Daniel A. Carrión (Department of Pasco; see Map 21).

Specimens Examined

Department Ancash

Province Aija: Near Puente de Monserrate, in the vicinity of Succhapampa, 2800 m alt., just at the base of Cuesta del Mellizo, along the foot trail from Huayán to Aija, only plantlets and three small tubers were collected, 25 April 1983, *C. Ochoa 15189* (CIP, OCH, from plants propagated in the greenhouse at Huancayo).

Province Bolognesi: Pancal, 3120 m alt., Cave of Luis Pardo, subxerophytic mountain, flowers purple, 16 April 1961, *E. Cerrate 3760* (OCH, USM).

Province Pallasca: Yana Cocha, 3250 m alt., near Conchucos, 16 March

1964, C. *Ochoa S-59*, 2n=24 (= *PI-365362*), only the seeds were collected (OCH, WI, from plants grown at Sturgeon Bay, Wis., U.S.A., summer 1987, and at Huancayo).

Department Huánuco

Province Ambo: Roadsides, near San Rafael, 2200 m alt., between Cerro de Pasco and Huánuco, February 1944, *W. H. Hodge 6217* (F). Between San

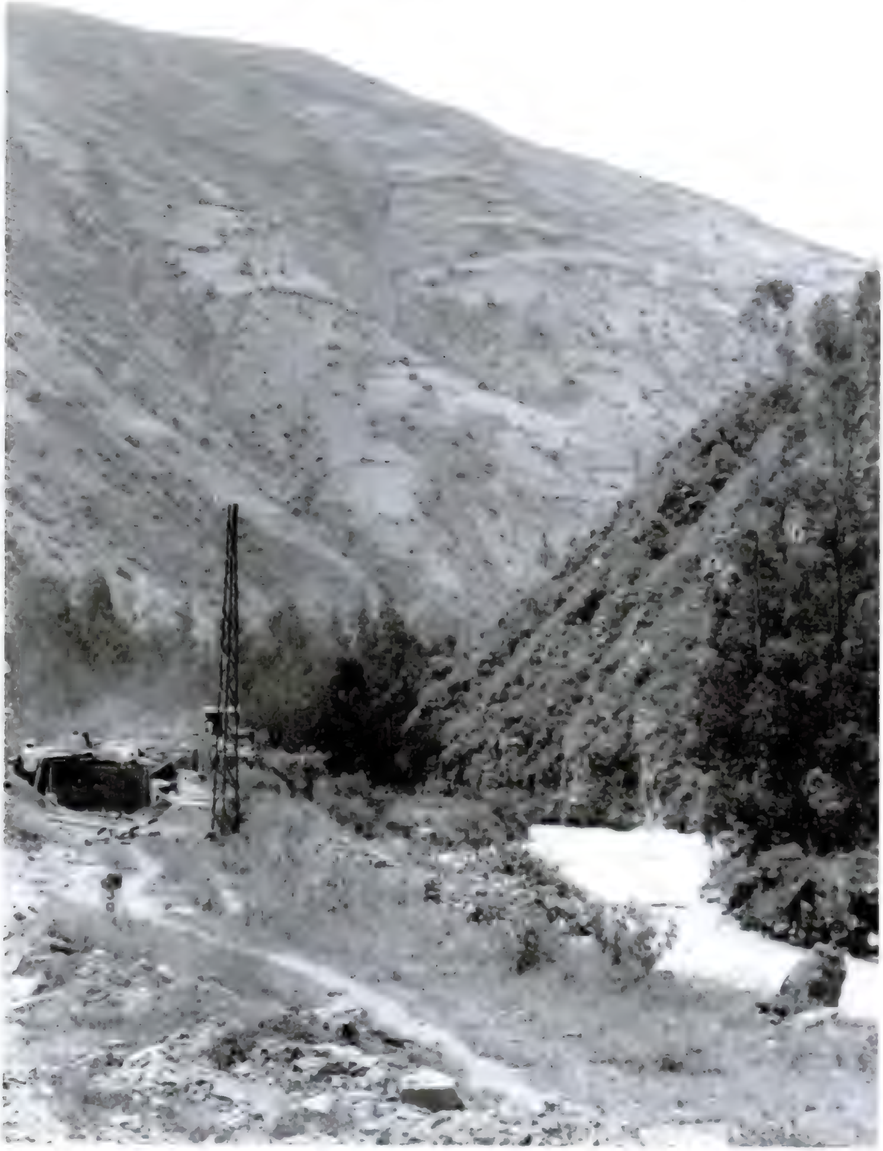


Figure 224. Km 38 between San Rafael and Ambo, type locality of *Solanum ambosinum* totally deprecated. Photo: February 1982.

Rafael and Ambo, 2200 m alt., along the edges of the road, abundant, flowers violet, 22 January 1947, *C. Ochoa 18* (BIRM, CUZ, OCH). Between Ambo and San Rafael, near km 38 of the road Pasco-Huánuco, 2300-2500 m alt., 16 March 1951, *C. Ochoa 1040* (OCH, type collection of *S. ambosinum*). Lasacancha, Huambo, ca. 2850 m alt., 26 December 1963, *C. Ochoa s.n.* (OCH, from plants grown at La Molina, Lima, floral dissection only). Between Ambo and San Rafael, 2400 m alt., collected mature berries, 30 April 1967, *C. Ochoa S-47* (= *PI-365316*), 2n=24 (OCH, from plants grown at Sturgeon Bay, Wis., U.S.A., summer 1987). Near Ambo, 2400 m alt., scarce, past flowering, 1 May 1967, *C. Ochoa 2653* (OCH). Between kms 366 and 367 of the road Pasco-Huánuco, 2600 m alt., 6 March 1977, *C. Ochoa 11299*, 2n=24 (CIP, F, GH, MOL, NY, OCH, US), (OCH, from plants propagated at Huancayo) and (OCH, from plants propagated at La Molina, Lima). Right bank of the Huertas River, 2500 m alt., entering by the Quebrada de Huacar, among trees of *Schinus molle* and in large subxerophytic areas covered by cactus (*Espostoa* sp.*)* and *Fourcroya*, 12-20 April 1980, *C. Ochoa 13838*, 2n=24 (OCH, from senescent plants). Buena Vista, 2420 m alt., near old km 38 of the road Cerro de Pasco-Huánuco, today km 373, 18 April 1980, *C. Ochoa 13848*, type locality of *S. ambosinum* (CIP, MOL, OCH, US, USM, topotypes of *S. ambosinum*). Banks of the Yanacocha River, near Huacar, 2300 m alt., entering by Ambo along the road to Yanahuanca, among trees of molle and chirimoya, 18 April 1980, *C. Ochoa 13849* (CIP, MOL, OCH). Chacapampa, 2450 m alt., heading up by road from Ambo to Yanahuanca, in a xerophytic zone, 18 April 1980, *C. Ochoa 13850* (CIP, F, GH, NY, OCH, US). Villa Lucma, 2500 m alt., heading up by road from Ambo to Yanahuanca, xerophytic region, 18 April 1980, *C. Ochoa 13851* (OCH). Chacapampa, 2500 m alt., along the route Ambo-Yanahuanca, among cacti, molles and carrizos, 18 April 1980, *C. Ochoa 13852* (CIP, GH, MOL, OCH, US). At km 371 of the road Cerro de Pasco-Huánuco, 2420 m alt., between Ambo and San Rafael, associated with *Bromelia*, *Opuntia,* various *Compositae* and grasses, 19 April 1980, *C. Ochoa 13853* (OCH). Buena Vista, 2420 m alt., near old km 38 of the road Cerro de Pasco-Huánuco, type locality of *S. ambosinum*, today changed to km 373, associated with *Agave* sp., various species of cacti and herbs such as *Bidens, Commelina, Dodonea, Ipomoea, Lycopersicon, Oxalis, Sicyos and Tillandsia*, columnar cactus and trees, including *Caesalpinia spinosa and Schinus molle,* 8 February 1982, *C. Ochoa 14556* (CIP, F, NY, OCH, US, WI, topotypes of *Solanum ambosinum*). Tecte, 2520 m alt., between San Rafael and Ambo, 8 February 1982, *C. Ochoa 14557* (CIP, F, GH, MOL, OCH, US) and *14558* (OCH).

Province Dos de Mayo: Amid the ruins of Huánuco Viejo, 3675 m alt., 30 April 1967, *C. Ochoa 2651* (OCH, US).

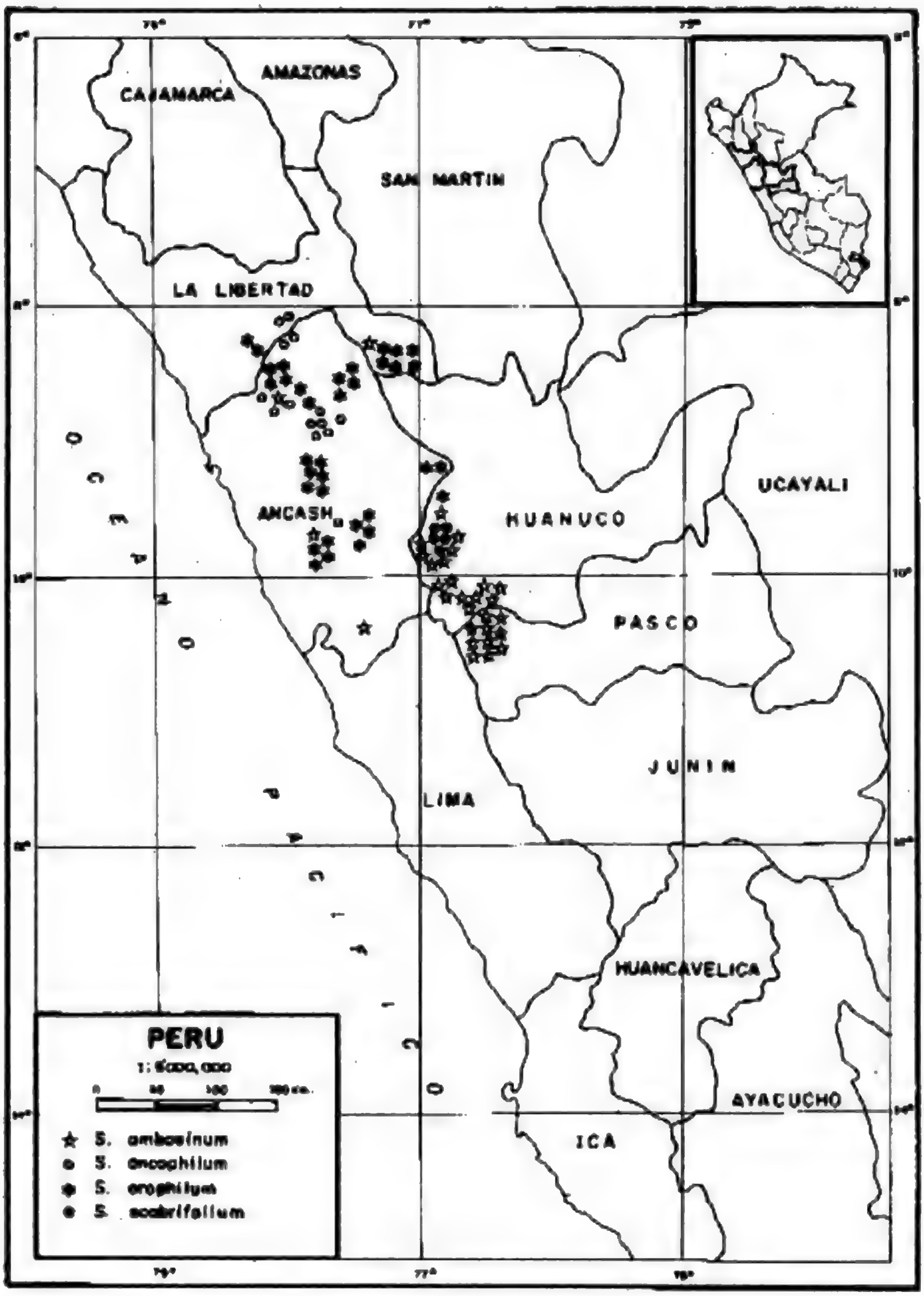
Province Huamalíes: Lower slopes of Cerro Llacui, 3350 m alt, amid the ruins, scarce, specimen without flowers, past flowering, 23 April 1961, C. *Ochoa 2354-A* (OCH). Portachuelos, 3200 m alt., District Arancai, scarce, 29 April 1961, C. *Ochoa 2368* (OCH). Near Chequias, 3160 m alt., District Arancay, from the middle of the Chequias road to the Marañón River, 30 April 1961, C. *Ochoa 2369* (OCH). Jalcas de Huancash, 3350 m alt., in the District of Jircán, n.v. *Auquillo Papa* (= Grandfather Potato), plants senescent, without flowers, 30 April 1961, C. *Ochoa 2371* (OCH). Near Chequias, 3160 m alt., District Arancay, mature tubers only were collected, 30 April 1961, C. *Ochoa 2389*, 2n=24 (OCH, from plants grown at Escuela National de Agricultura La Molina, Lima). Huerga, 3340 m alt., between Taricay and Playa, along the route to Llata via Chuquis, 22 April 1967, C. *Ochoa 2636* (MOL, OCH, US) and *2636-A* (CIP, OCH, USM, from plants grown in the greenhouse at Universidad Nacional Agraria La Molina, Lima).

Department Pasco

Province Daniel A. Carrión: Vicinity of Huaquilla, ca. 3200 m alt., District of Tusi, near Pucará and Pampania, tubers only were collected, 30 March 1963, C. *Ochoa 2469* (OCH, from plants grown in October 1963 at the Escuela National de Agricultura La Molina, Lima, propagated from the original tubers). Huaquilla, ca. 3200 m alt., District of Tusi, near Pucará and Pampania, C. *Ochoa S-61*, 2n=24 (= *PI-365317)* from intercrosses of plants obtained from a single berry ("sib-crosses"), grown at Escuela National de Agricultura La Molina, Lima, 11 January 1964 (WI herbarium, from plants grown at Sturgeon Bay, Wis., U.S.A., summer 1987). Below Shogue, 2900 m alt., heading down from Pampania by the quebrada of the Tusi River, plants very vigorous more than 1.50 m alt., tubers ovoid, large, 8-10 cm long, March 1973, C. *Ochoa 3881*, 2n=24 (OCH). Banks of the Yanahuanca River, 2690 m alt., 40 km from Ambo, along the route Ambo-Yanahuanca, 8 March 1977, C. *Ochoa 11298*, 2n=24 (CIP, F, GH, MOL, NY, OCH, UNTC, USM, US). Chosej, 2700-2800 m alt., below Shogue, heading down from Pampania by the quebrada of the Tusi River, near Antapirca, 28 January 1978, C. *Ochoa 11865*, 2n=24 (CIP, F, GH, MOL, NY, OCH, UNTC, USM, US). Sillapata, 2900 m alt., heading up to Padre Rume, subxerophytic zone, among bromeliads, *Dodonea viscosa, Fourcroya* and *Shinus molle*, n.v. *Purum Papa*, February 1982, C. *Ochoa 14579* (CIP, MOL, OCH). Padre Rume, 3000-3100 m alt., above Sillapata, along the road detour from Ambo, in rocky areas, February 1982, C. *Ochoa 14580*, 2n=24 (CIP, OCH). Near Paucarbamba bridge, 2620 m alt., along the route to Yanahuanca, flowers purple, 13 February 1982, C. *Ochoa 14602* (CIP, OCH) and *14603*, 2n=24 (CIP, F, OCH, US). Above the Paucarbamba bridge, 2700 m alt., at the exit to Yanahuanca, via Uspachara, 13 January 1982, C. *Ochoa 14605*, 2n=24 (CIP, F, OCH, US).

Figure 225. Greetings from the author at Río Huacar, tributary of the Río Huallaga, about 5 km west of the type locality of *Solanum ambosinum*.

material



Map 21. Distribution of *S. ambosinum* in Ancash, *S. ancophilum*, *S. orophilum* and *S. scabrifolium*.

Breeding Potential

The results of crosses of *S. ambosinum* with diploid species (2n=24) of EBN=2 are given in Table 60, while the field materials used for these experiments are shown in Table 61.

Seed set was high in reciprocal crosses of *S. ambosinum* and *S. orophilum*, *S. bukasovii*, *S. huancabambense* and *S. leptophyes*. However, reciprocal crosses made with S. *ardiuphilum* and *S. piurae* were only partially compatible, yielding but few seeds and then only when *S. ambosinum* was used as the pistillate parent. Again crosses with *S. coelestispetalum*, *S. sparsipilum* and the cultivated species *S. goniocalyx*, *S. phureja* and *S. stenotomum* were successful only when *S. ambosinum* was used as the pistillate parent but, in all of the above mentioned cases, a larger number of seeds were obtained. However, no success was had at all in the reciprocal crosses made with *S. chomatophilum* of Series Conicibaccata, though unilateral cross with *S. rhombilanceolatum* of the same series gave moderate results. Similarly, some compatibility was found in unilateral crosses of *S. ambosinum* with *S. sogarandinum* of the Series Megistacroloba.

Table 60. Fertility of *Solanum ambosinum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	2	CONICIBACCATA	× *S. chomatophilum*	28(49)	18(6)	0(0)
			× *S. rhombilanceolatum*	6	4	35
24	2	MEGISTACROLOBA	× *S. sogarandinum*	4	2	20
24	2	PIURANA	× *S. ariduphilum*	20(4)	18(1)	20(0)
			× *S. piurae*	22(6)	12(3)	9(0)
24	2	TUBEROSA	× *S. bukasovii*	44(88	37(66)	148(246)
			× *S. coelestispetalum*	3	3	233
			× *S. goniocalyx*	39	24	130
			× *S. huancabambense*	22(10)	12(6)	142(83)
			× *S. leptophyes*	3(4)	3(4)	227(100)
			× *S. orophilum*	12(17)	11(7)	331(50)
			× *S. phureja*	44	34	117
			× *S. sparsipilum*	14	8	106
			× *S. stenotomum*	11	4	100

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 61. Collections (OCH) used in *Solanum ambosinum* fertility studies.

CONICIBACCATA
S. chomatophilum 13196, 13203, 13206, 13210
S. rhombilanceolatum 14406

MEGISTACROLOBA
S. sogarandinum 13006

PIURANA
S. ariduphilum 2637
S. piurae 11615, 13959

TUBEROSA
S. ambosinum 11298, 11865, 13849, 13850, 13852, 15115
S. bukasovii 11841, 11876, 13115, 13166 13168, 13173, 13174, 13599, 13600, 13715, 13856, 13858, 13859, 13860, 13862, 13867, 14355, 14654
S. coelestispetalum 13609
S. goniocalyx 00001
S. huancabambense 11619, 11627
S. leptophyes 13731
S. orophilum 12071, 12079, 13020
S. phureja 5443, 9030, 13901, 13909
S. sparsipilum 13588, 13774
S. stenotomum 13922

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47. *Solanum ancophilum* (Corr.) Ochoa *sp. et stat. nov.* Phytologia 54(5):392, 1983.

Figs. 226-230; Map 21.

S. rhomboideilanceolatum Ochoa var. *ancophilum* Corr. Wrightia 2:195, 1961.

Plant erect or erect-decumbent to decumbent, (15-)30-40(-50) cm tall, pubescent; stem usually simple, slender, 2-5 mm in dia. at the base, lightly spotted with violet, straight or slightly flexuous, sparsely pilose, hairs silvery-white, unequal, 2-4 mm long; internodes (1.0-)2.0-4.5 cm long. Stolons 30-40(-60) cm long; tubers white, round or ovoid, small, 1-3 cm long. Leaves (4.5-)7.5-12.0 cm long by (3.5-)5.5-8.5 cm wide, imparipinnate, little divided, with 2-3 pairs of lateral leaflets and 0-2(-3) pairs of interjected leaflets, pilose on both sides and along the margins, hairs short, adpressed, more or less sparse above, longer and somewhat more densely distributed on the nerves below, rachis and petiolules also pilose. Terminal leaflet ovate-lanceolate to elliptic-lanceolate, apex pointed or subpointed, base rounded or slightly cuneate, somewhat longer and wider than the adjacent leaflets, (2.8-)3.0-6.5 cm long by (1.5-)2.0-3.0 cm wide. Lateral leaflets elliptic-lanceolate, apex obtuse, base sessile or subsessile; leaflets of the first upper pair (2.0-)2.5-5.0 cm long by (1.0-)1.5-2.0) cm wide, occasionally narrowly decurrent about the rachis along the basiscopic side. Pseudostipular

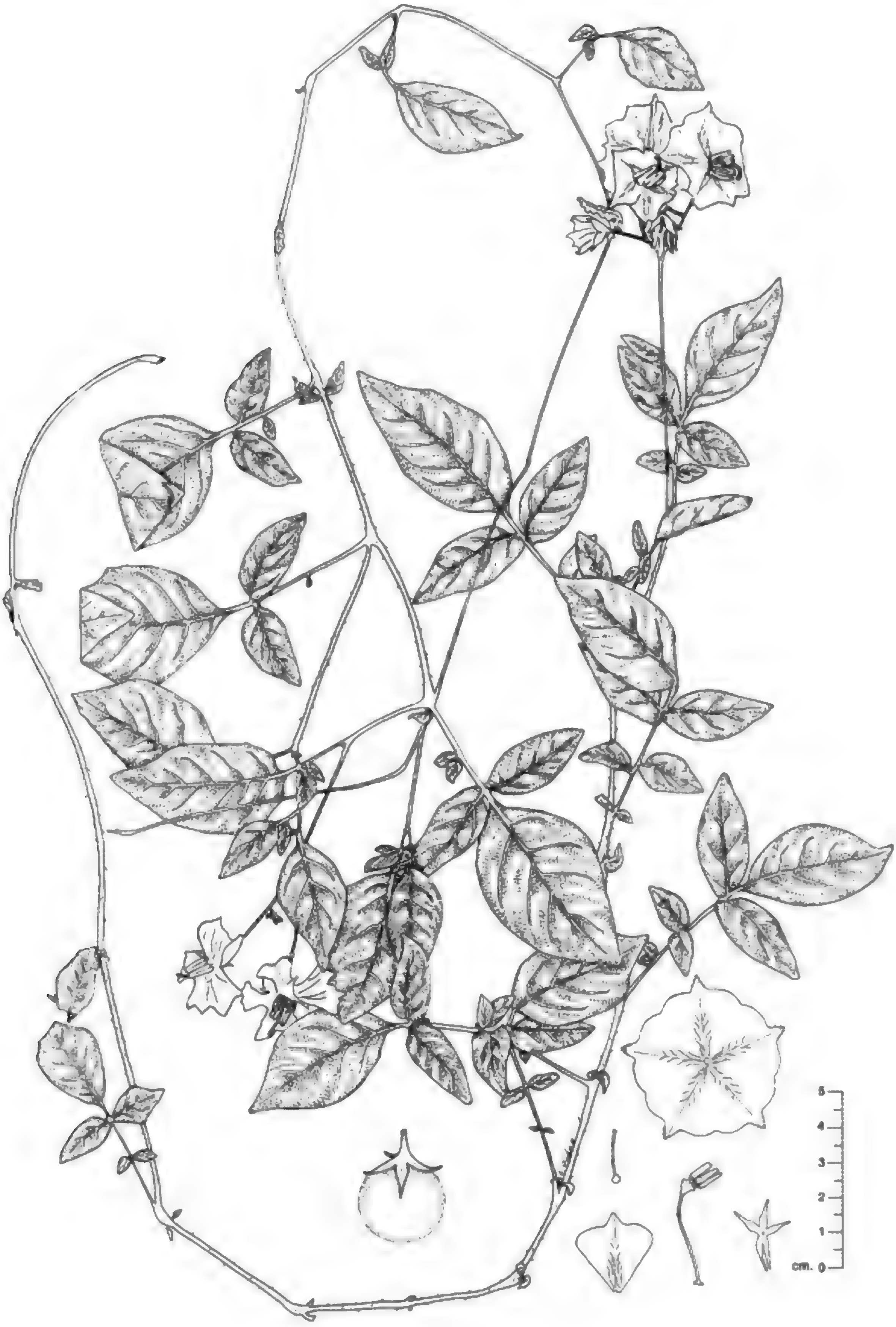


Figure 226. *Solanum ancophilum* (Corr.) Ochoa, *sp. et stat. nov.* (*Ochoa 12086*).

leaves narrowly falcate, 7-11 mm long by 2.5-4.0 mm wide. Inflorescence cymose to cymose-paniculate, (4-)10-14-flowered; peduncle 3-5(-7) cm long, slender and sparsely pilose as in the case of the pedicels and the calyx; pedicels 20-30 mm long; articulated about 6-7 mm below the base of the calyx. Calyx asymmetrical, 9-10 mm long, pigmented; lobes narrowly elliptic-lanceolate, the margins narrowly scarious at base, abruptly narrowed to the pointed or subspatulate 2-3 mm long acumens. Corolla rotate to rotate-pentagonal, 3.0-3.5(-4.0) cm in dia. (Figs. 226, 227), bluish-lavender or purple-violet, the acumens short and densely puberulent along the apical margins. Anthers narrowly lanceolate, 6.5-7.0 mm long, distinctly cordate at base; filaments 1-2 mm long, glabrous or with a few setose hairs. Style to 12.5 mm long, exerted 2.5-3.5 mm, densely papillose along the lower two-thirds of its length, alternating (but not always) with a few, sparsely distributed setose hairs; stigma capitate, cleft, very small. Fruit globose, 2 cm in dia., dark green with sparsely distributed white dots, not verrucose (Fig. 228). Chromosome Number: 2n=24. EBN=2. Proposed Abbreviation: ANC.

Type: PERU. Department Ancash, Province Yungay, in a quebrada of a glacial valley among stones, northwestern foothills of the Nevado Huascarán, below Llanganuco, 3500 m alt., 29 March 1960, *D. S. Correll and E. E. Smith P957* (K, LL, MO, NY, S, US, USM).

The erect-decumbent to decumbent habit of *S. ancophilum* is clearly manifested in the populations of this species that grow in and among the crevices and hollows of the rocks that are located near the banks of the Llanganuco Lagoon. Specimens which well illustrate this habit can be seen in Correll's type collection of "var. *ancophilum*" (*No. P957*) and in the topotypes collected by the author (*Ochoa 12086*). These last two collections, along with several other collections of plants ranging in size and habit from very small or dwarf to upright or erect (*Ochoa 12099* and *13001*, and *Ochoa and Salas 16204*), are representative of the range of variation to be found within this species, and comprise the material from which the above description has been drawn.

Affinities

Solanum ancophilum is related to *S. rhombilanceolatum*. The two are similar in having a rotate or rotate-pentagonal corolla, elliptic-lanceolate lateral leaflets and leaves that are only poorly divided. They differ, however, with respect to fruit shape and in the relative density of the pubescence that covers the entire plant. Especially evident in this latter regard is the density of the silvery-white indumentum that covers the leaves of *S. ancophilum*.

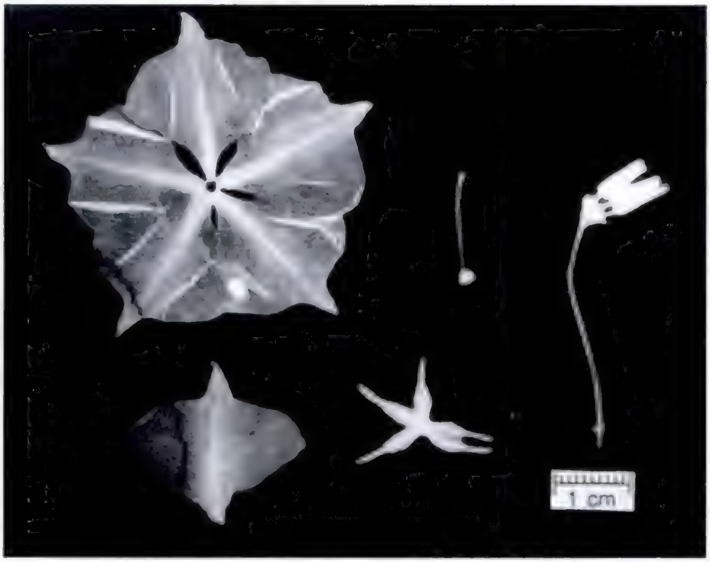


Figure 227. Floral dissection of *Solanum ancophilum* (*Ochoa 12086*).

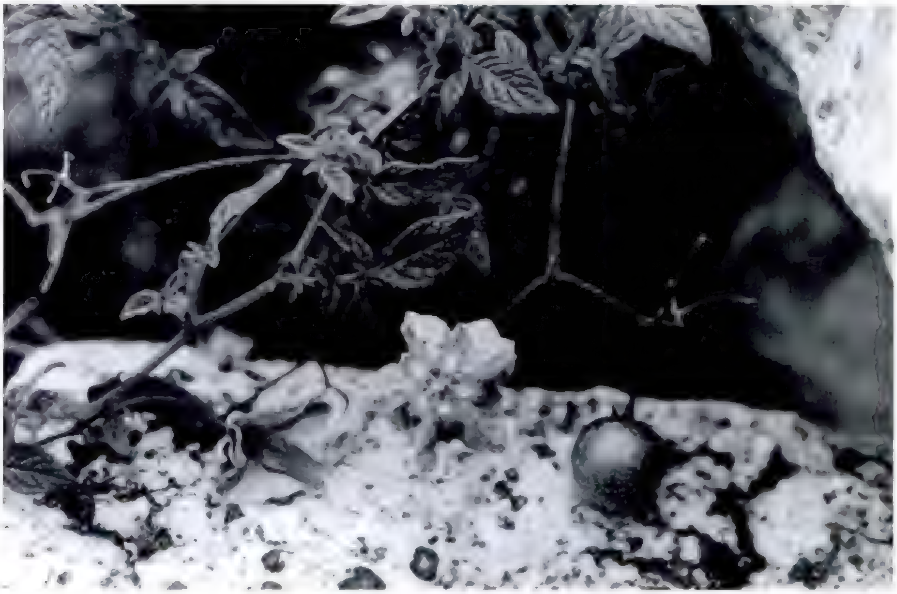


Figure 228. *Solanum ancophilum* in full flower and fruit at its type locality.

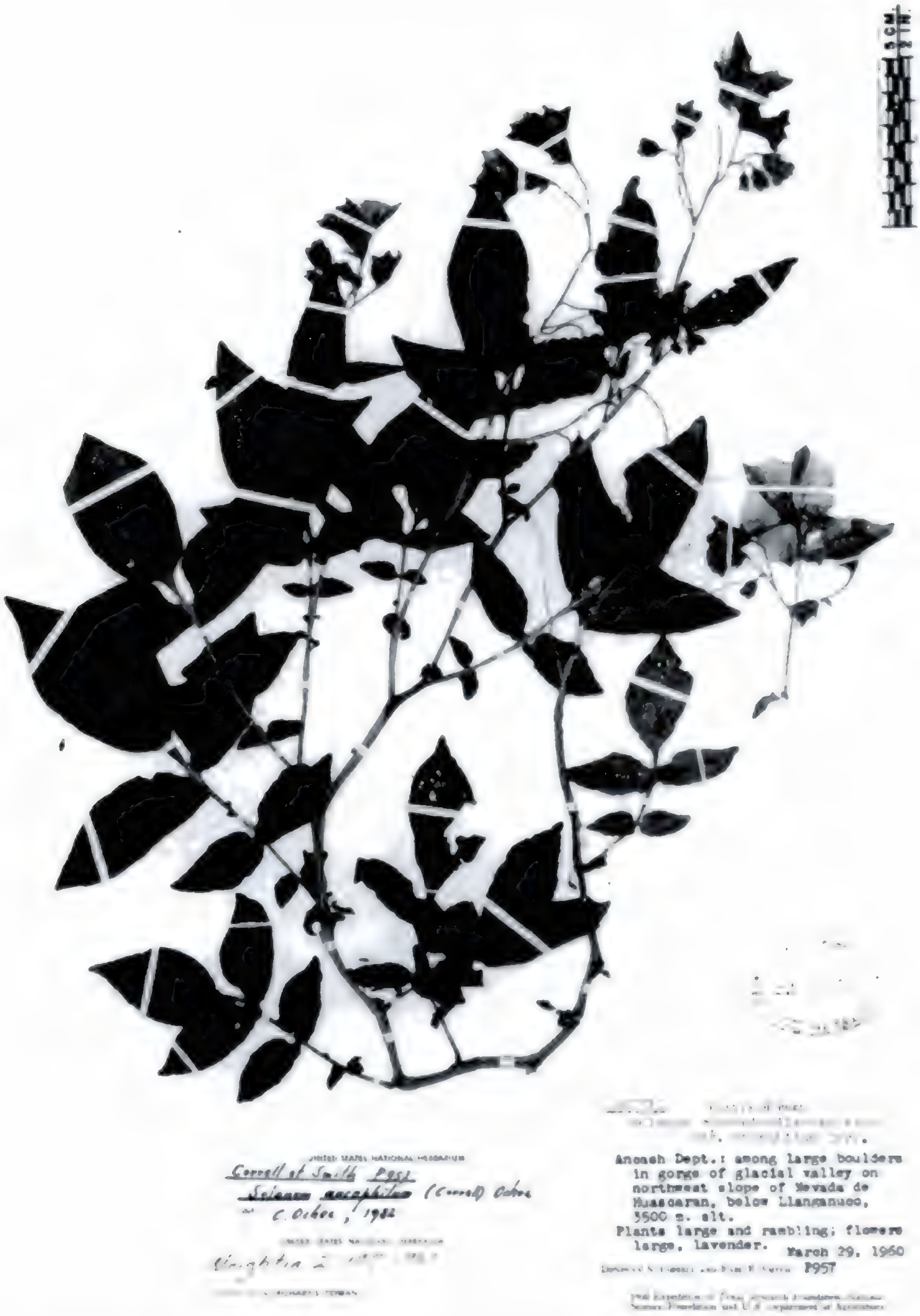

UNITED STATES NATIONAL HERBARIUM
Correll et Smith P957
Solanum ancophilum (Correll) Ochoa
C. Ochoa, 1982
UNITED STATES NATIONAL HERBARIUM
Ancash Dept.: among large boulders in gorge of glacial valley on northwest slope of Nevada de Huascaran, below Llanganuco, 3500 m. alt.
Plants large and rambling; flowers large, lavender.
March 29, 1960
P957

Figure 229. Type collection of *S. rhomboideilanceolatum* var. *ancophilum* (*Correll and Smith P957*). Photo: Courtesy of the Department of Botany at the Smithsonian Institution (US).

Habitat and Distribution

Although this species is sometimes found in the interandean valleys and low mountain ranges of Peru at elevations ranging between 2600 and 3200 m alt., it is basically a high altitude species, preferring elevations between 3500 and 4300 m and *jalca* habitats in the near vicinity of mountain glaciers. In these latter habitats it grows in association with *Polylepis*, *Lupinus*, *Calceolaria*, *Verbena* and native pasture grasses, or occasionally with plants of *S. chomatophilum*. It is found commonly in rocky, clay-sandy soils or in the gravelly soils of mountain foothills, where it is often found growing in and between the crevices and hollows of large rock piles.

The major area of distribution of this species lies in the Department of Ancash, and particularly in the foothills of the Alpamayo, Huascarán and Huandoy Mountains that form part of the great Cordillera Blanca. It also occurs to a lesser extent in the Province of Santiago de Chuco in the Department of La Libertad in northern Peru (Map 21).

Specimens Examined

Department Ancash

Province Carhuaz: Quebrada Ulta, 4280 m alt., (77° 32' W, 9° 08' S), on road to Ulta Pass. *Polylepis weberbauerii* woods, WNW-facing, steep slopes, old rockfall, herb, erect to clambering, flowers pale violet, July 29, 1985, *D. N. Smith 11385* (MO). Near entrance of Ulta Canyon, 3400 m alt., between Huaypán and the Ulta lagoon, about 24 km from Carhuaz along the route to Chacas, entering by Shilla, in rocky soil and clearings "*rozo de monte*," growing with *Calceolaria, Lupinus* and *Salvia*, 5 April 1995, *C. Ochoa and A. Salas 16204* (CIP, OCH).

Province Corongo: Quebrada of Cerro Chorten, near Aco, 3300 m alt., tubers white, round to ovoid, small (10 mm), 3-6 May 1978, *C. Ochoa 12099*, 2n=24 (CIP, GH, MO, MOL, OCH, US, USM). Lower levels of Cerro Pariacón, 3350 m alt., above Bambas, 3-6 May 1978, *C. Ochoa 13001* (OCH).

Province Huaraz: On bank along road between Huaraz and Recuay, near km 383, 3250 m alt., plant bushy, branched, flowers lavender-purple, rotate, March 30, 1960, *D.S. Correll and E.E. Smith P965* (LL, US).

Province Huaylas: Huascaran National Park, Quebrada Los Cedros, Alpamayo trail, 4020-4700 m alt., (77°44'W, 8°50'S), *puna* grassland, N-facing, steep slopes, some cliffs and talus slopes, herb, flowers pale violet, March 11, 1985, *D. N. Smith, R. Valencia, and L. Minaya 9916* (MO, UNTC).

Province Pallasca: Vicinity of Pallasca, 3190 m alt., in foothills of a rocky mountain, 26 May 1963, C. *Ochoa 2520* (MOL, OCH, UNTC, USM). Foothills of Cerro Miraflores, near Yacúa, above Ancos, ca. 3000 m alt., 4 March 1967, C. *Ochoa 2614* (OCH).

Province Yungay: In grassy areas among shrubs on road from Yungay to Llanganuco, 3500 m alt., flowers lavender, rotate, March 29, 1960, *D.S. Correll and E.E. Smith P954* (LL). Among large boulders in gorge of glacial valley on northwest slope of Nevado Huascarán, below Llanganuco, 3500 m alt., plant large and rambling, flowers large, lavender. March 29, 1960, *D.S. Correll* and *E.E. Smith P957* (K, LL, NY, US, type collection of *S. rhombilanceolatum* var. *ancophilum* Corr.). Llanganuco, 3750 m alt., near shores of the second lagoon, among stones, very abundant, forming large colonies, corolla large, bluish-lavender, fruits round, 17 April 1978, C. *Ochoa 12086*, 2n=24 (CIP, F, GH, OCH, MOL, US, topotypes of "var. *ancophilum*"), *12086A* (OCH) and *12086B* (CIP, GH, MOL, OCH, US, from plants grown at the CIP Experimental Station at Huancayo)

Department La Libertad

Province Santiago de Chuco: Huaichaca (Cachicadán), 2600 m alt., roadside, herbaceous, tuber-bearing, flowers purple, April 1950, *A. López M. 0444* (OCH). Along the road detour to Patarata, 3480 m alt., between Santiago de Chuco and Cachicadán, 21 May 1963, C. *Ochoa 2505* (MOL, OCH, USM).

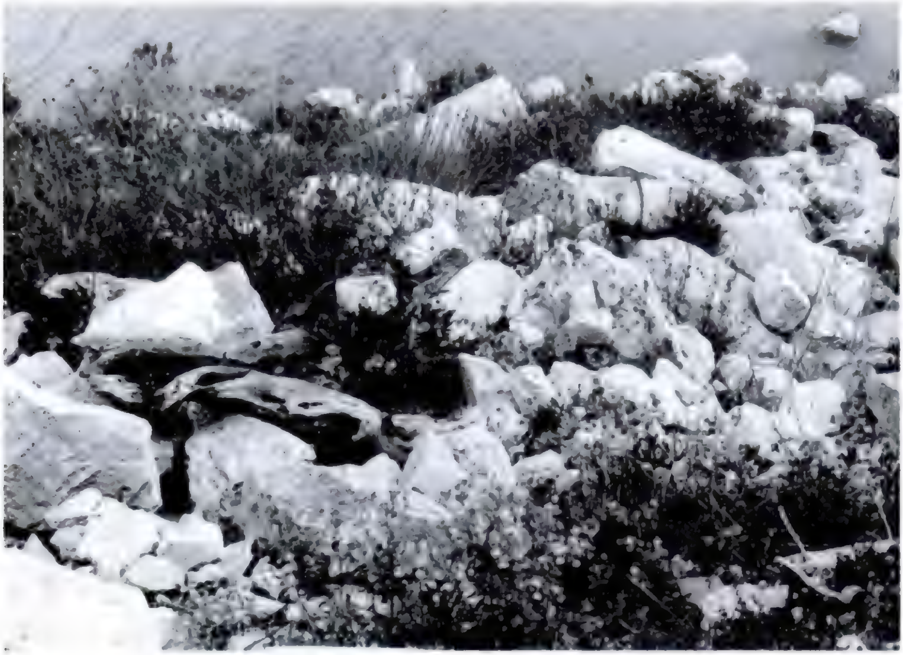


Figure 230. Habitat and type locality of *Solanum ancophilum*, shores of Lake Llanganuco, Ancash.

Breeding Potential

The results of crosses of *S.ancophilum* with diploid species (2n=24) of EBN=1 and 2 and hexaploids (2n=72) of EBN=4 are given in Table 62, while the field materials used for these experiments are shown in Table 63.

The results of the few reciprocal crosses that were made with *S. ancophilum* were completely unexpected. Absolutely no seed was obtained in crosses of this species with *S. dolichocremastrum*, *S. raphanifolium* and *S. sogarandinum*, all of Series Megistacroloba. However, *S. ancophilum* was found to be partially compatible with the hexaploid species *S. albicans* of Series Acaulia. When the latter species was used as the pistillate parent, some 26 fertile seeds per fruit were obtained, even though this species is from a series very distant from that of Tuberosa and has an EBN value of 4. On the other hand, the unilateral crosses of *S. ancophilum* that were attempted with *S. phureja* were unsuccessful, despite the fact that both species are of the same series and have identical chromosome numbers and numerical endosperm values. However, unilateral crosses with *S. rhombilanceolatum*, a species which also has an EBN value of 2 but is of Series Conicibaccata, gave an average of 5 seeds per berry. The results of this last cross, in particular, are important as they underscore the differences in relationship between *S. ancophilum* and *S. rhombilanceolatum* as interpreted by the present author and Correll (1962), who regarded *S. ancophilum* as merely a variety of *S. rhombilanceolatum*. In the present treatment, these two entities are regarded not only as good taxonomic species, but as members of two distinct taxonomic series.

Table 62. Fertility of *Solanum ancophilum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	MEGISTACROLOBA	× *S. dolichocremastrum*	6(8)	0(0)	0(0)
24	2	CONICIBACCATA	× *S. rhombilanceolatum*	5	2	5
24	2	MEGISTACROLOBA	× *S. raphanifolium*	10(9)	0(3)	0(0)
			× *S. sogarandinum*	16(3)	0(0)	0(0)
24	2	TUBEROSA	× *S. phureja*	7	0	0
72	4	ACAULIA	× *S. albicans*	39(17)	1(2)	0(26)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 63. Collections (OCH) used in *Solanum ancophilum* fertility studies.

ACAULIA
S. albicans 12091

CONICIBACCATA
S. rhombilanceolatum 14406

MEGISTACROLOBA
S. dolichocremastrum 12074
S. raphanifolium 13704, 14299
S. sogarandinum 13006, 13235

TUBEROSA
S. ancophilum 12086A, 12086B, 12099
S. phureja 15071

48. ***Solanum ancoripae*** Ochoa *sp. nov.* (See Latin diagnosis in Spanish edition).

Figs. 231-235; Map 19.

Plant erect, slender, luxuriant, 30-40 cm tall, glabrescent or very sparsely and shortly pilose. Stem erect, simple or branched, 3-5 mm in dia. at the base, very narrowly straight winged, internodes (1.5-)2.5-3.5 cm long. Plant stoloniferous and tuber-bearing, stolons to 90 cm long, slender, 1.0-1.5 mm in dia.; tubers white, globose to ovoid, small, 1-2 cm long. Leaves imparipinnate, (14.5-)19.0-21.0(-24.5) cm long by (8-)10-11(-13) cm wide, with 5 pairs of lateral leaflets and 6-10(-14) pairs of interjected leaflets of different size, 1-10(-25) mm long, sessile, leaves sparsely and shortly pilose above, somewhat more densely pilose or more puberulent below. Leaflets narrowly elliptic-lanceolate, the apex pointed or acuminate, terminal leaflet 4.5-7.5 cm long by 1.5-1.8 cm wide, long-acuminate, base narrowly cuneate or rounded. Lateral leaflets of the second upper pair, and at times also of the third upper pair, somewhat larger and with longer petiolules than those of the first upper pair; petiolules 1-4 mm long. Pseudostipular leaves broadly falcate, 7-10 mm long by 4-6 mm wide. Inflorescence cymose-paniculate, few flowered (6-8). Peduncle puberulent, 6(-9) cm long, slender, 1.5 mm in dia. at the base; pedicels puberulent, 20-25 mm long, very slender, less than 1 mm in dia., articulated in the upper one-third of their length or about 7-8 mm below the calyx. Calyx symmetrical or asymmetrical, shortly and finely pilose, 7.5-8.5 mm long, lobes narrowly elliptic-lanceolate narrowed to very pointed and filiform acumens 2.5-4.0 mm long. Corolla rotate to rotate-pentagonal, pale blue or blue-violet, small, 2.5-2.8 cm in dia. Anthers lanceolate, 4 mm long; filaments short, *ca.* 0.4 mm long, glabrous. Style 8-9 mm long, papillose

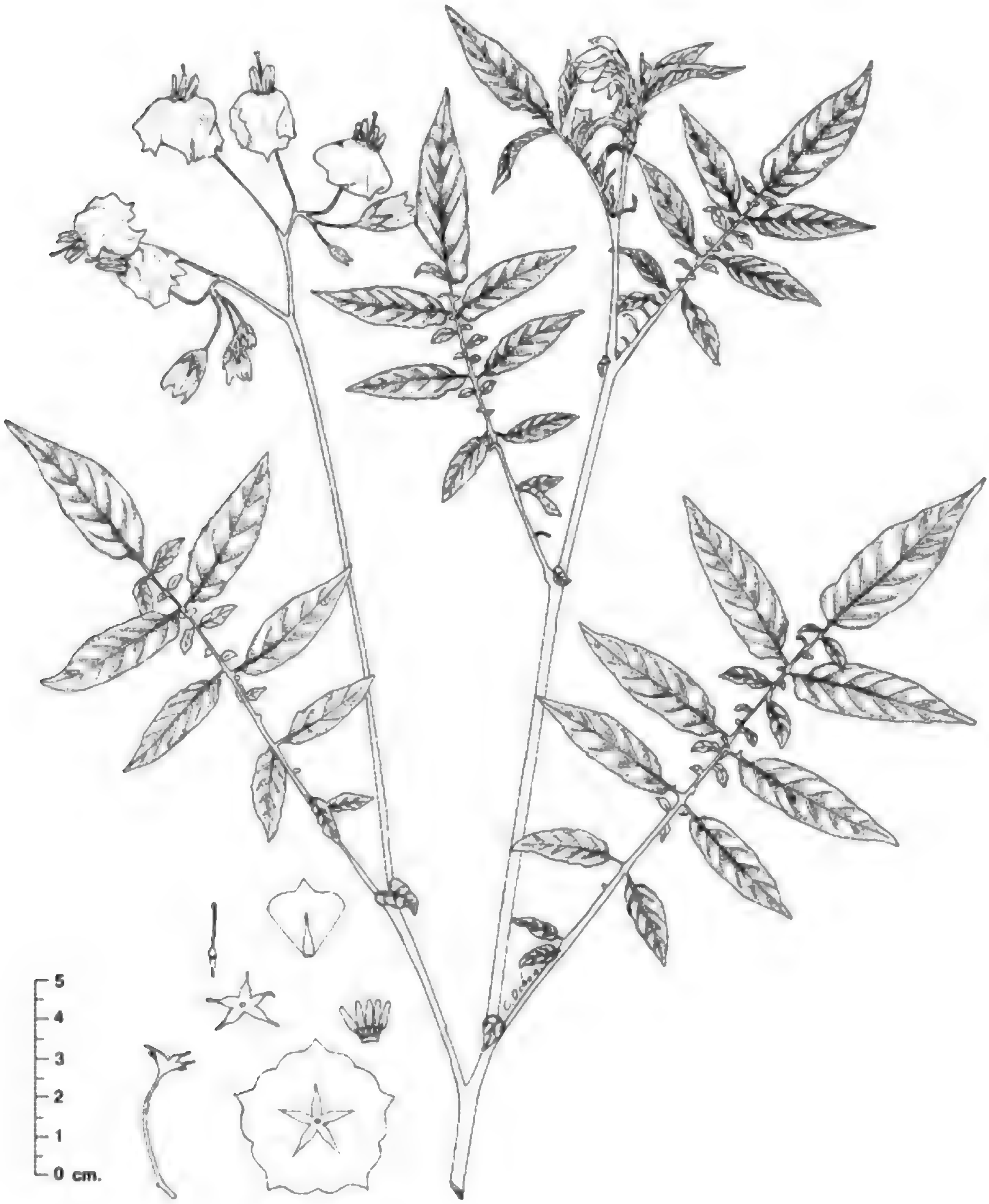


Figure 231. *Solanum ancoripae (Ochoa 13661).*

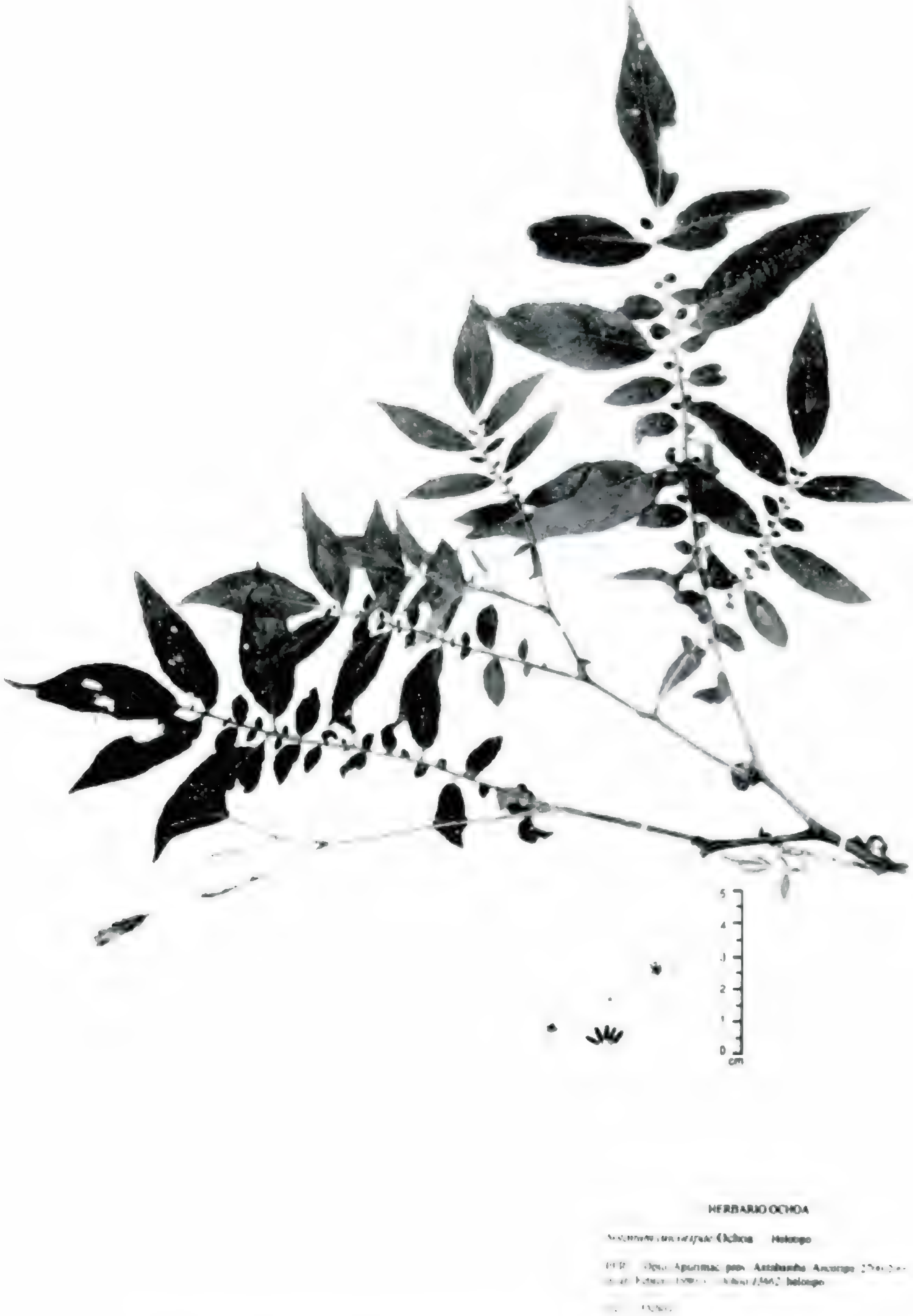


Figure 232. *Solanum ancoripae (Ochoa 13662*, holotype*)*.

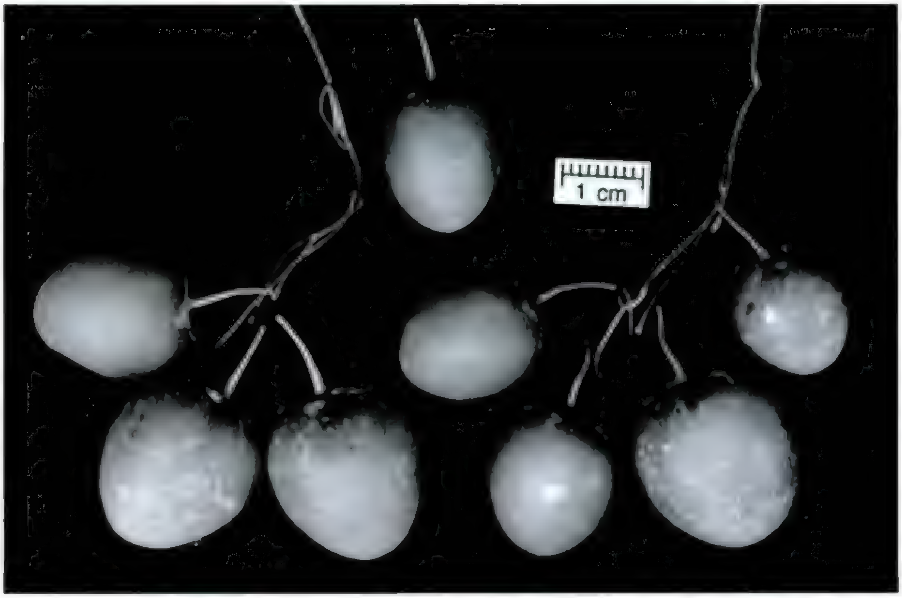


Figure 233. Fruits of *Solanum ancoripae* (*Ochoa 13662*, holotype).

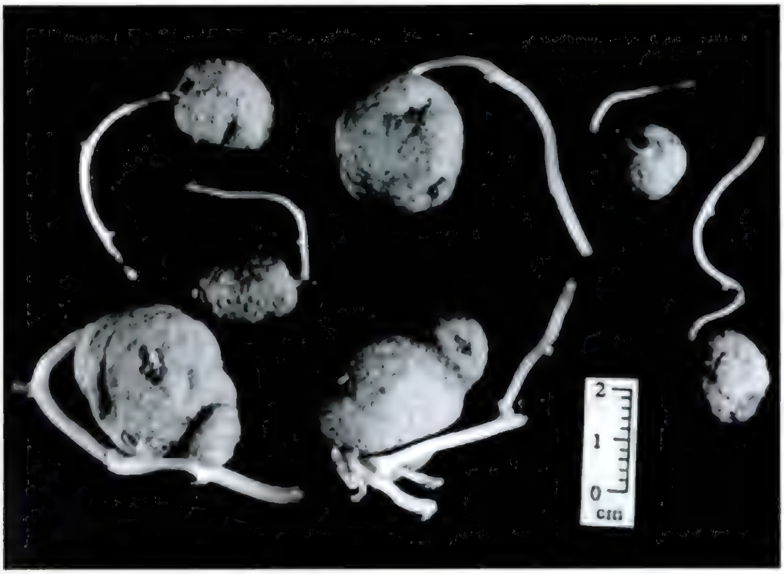


Figure 234. Tubers of *Solanum ancoripae* (*Ochoa 13662*, holotype).

along the lower two-thirds of its length; stigma subclaviform, cleft, very small. Fruit ovoid, 1.5-2.0 cm long, pure green or green with scattered white dots. Chromosome Number: 2n=24. Proposed Abbreviation: ANP.

Type: PERU. Department Apurímac, Province Antabamba, Ancoripa, 2700-2900 m alt., February 1980, C. *Ochoa 13662* (holotype OCH, isotype MOL).

Affinities

This species has certain characteristics in common with *S. leptophyes*, including the placement of the pedicel articulation and the size and shape of the corolla. However, it also differs from the aforementioned species in several important ways, including in the shape of its leaflets, size and shape of the calyx, nature of the indumentum and the ovoid form of the fruit.

Habitat and Distribution

The type locality of *S. ancoripae* lies in a narrow interandean valley having a temperate, but semiarid climate. It grows among shrubs of *Barnadesia* and small trees of *Schinus molle*, in a somewhat impoverished understory of herbaceous vegetation (Map 19).

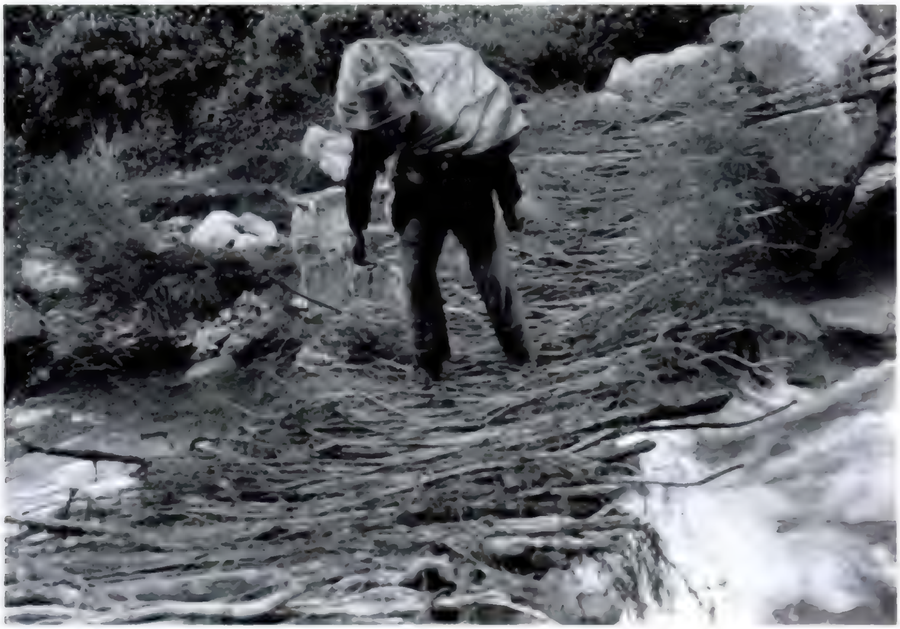


Figure 235. Banks of the Río Ckella, 3000 m alt., habitat of *S. ancoripae*.

Specimens Examined

Department Apurímac

Province Antabamba: Near banks of the Ckella River, 3000 m alt., 21 February 1980, *C. Ochoa 13661*, 2n=24 (OCH, from plants propagated in the greenhouse at Huancayo). Ancoripa, 2700-2900 m alt., February 1980, *C. Ochoa 13662* (MOL, OCH, type collection of *S. ancoripae*).

Province Grau: Vicinity of Chuquibambilla, 3000 m alt., growing in shrubby thickets in a small and narrow quebrada, 20 February 1960, *C. Ochoa 2221* (OCH).

49. *Solanum × arahuayum* Ochoa, Phytologia 77(2):96-98, illustr., 1994.

Figs. 236-237; Map 20.

Plant 50-60(-70) cm tall; stem erect, simple or branched, cylindrical, without wings, light green, sparsely pilose; hairs simple, multicellular, white, brilliant, 1.5-2.0 mm long, alternating with short tetralobular glandular hairs; internodes (2.5-)5.0-6.0(-14.0) cm long. Stolons 1 m long or more; tubers white, ovoid to oval-pyriform or flattened, 2-4 cm long by 1.0-1.8 cm thick. Leaves (10-)15-18 (-25) cm long by (7.5-)10.0-11.5(-16.0) cm wide, light green, sparsely pilose above, lighter green with shorter hairs below, with 3-4(-5) pairs of lateral leaflets and 3-6(-8) or more pairs of interjected leaflets. Rachis and petioles sparsely pilose, hairs long, simple, alternating with short tetralobular glandular hairs. Terminal leaflet larger to much larger than the laterals, 5.0-7.0(-9.5) cm long by 3.5-5.0(-6.0) cm wide, broadly elliptic-lanceolate, apex pointed or shortly acuminate, base rounded to obliquely rounded, shortly cuneate or narrowly decurrent. The first pair of lateral leaflets (3.8-)5.0-6.0(-8.0) cm long by (2.0-)2.5-3.5(-4.0) cm wide, decreasing gradually in size toward the base, the margins slightly wavy, apex pointed, base rounded to obliquely rounded, sessile and narrowly decurrent along the basiscopic side. Interjected leaflets of different size, 2-5(-12) mm long, narrowly elliptic-lanceolate to triangular-lanceolate, base membranous or decurrent. Pseudostipular leaves narrowly falcate to auriculate, 10-12 mm long by 5-6 mm wide. Inflorescence cymose to cymose-paniculate, 10-12(-20)-flowered, very showy; peduncles 3-4 cm or more long, covered, as in the case of the pedicels, with simple hairs and short tetralobular glandular hairs; pedicels articulated in the upper two-thirds of their length, or near calyx. Calyx symmetrical, 10-12 mm long, pilose, light green; lobes narrowly elliptic-lanceolate, broadly membranous, narrowing to subspatulate acumens, 5-7 mm long. Corolla rotate, large, 3.5-4.0 cm in dia. (Figs. 236-237), light lilac, internal star yellowish-green. An-

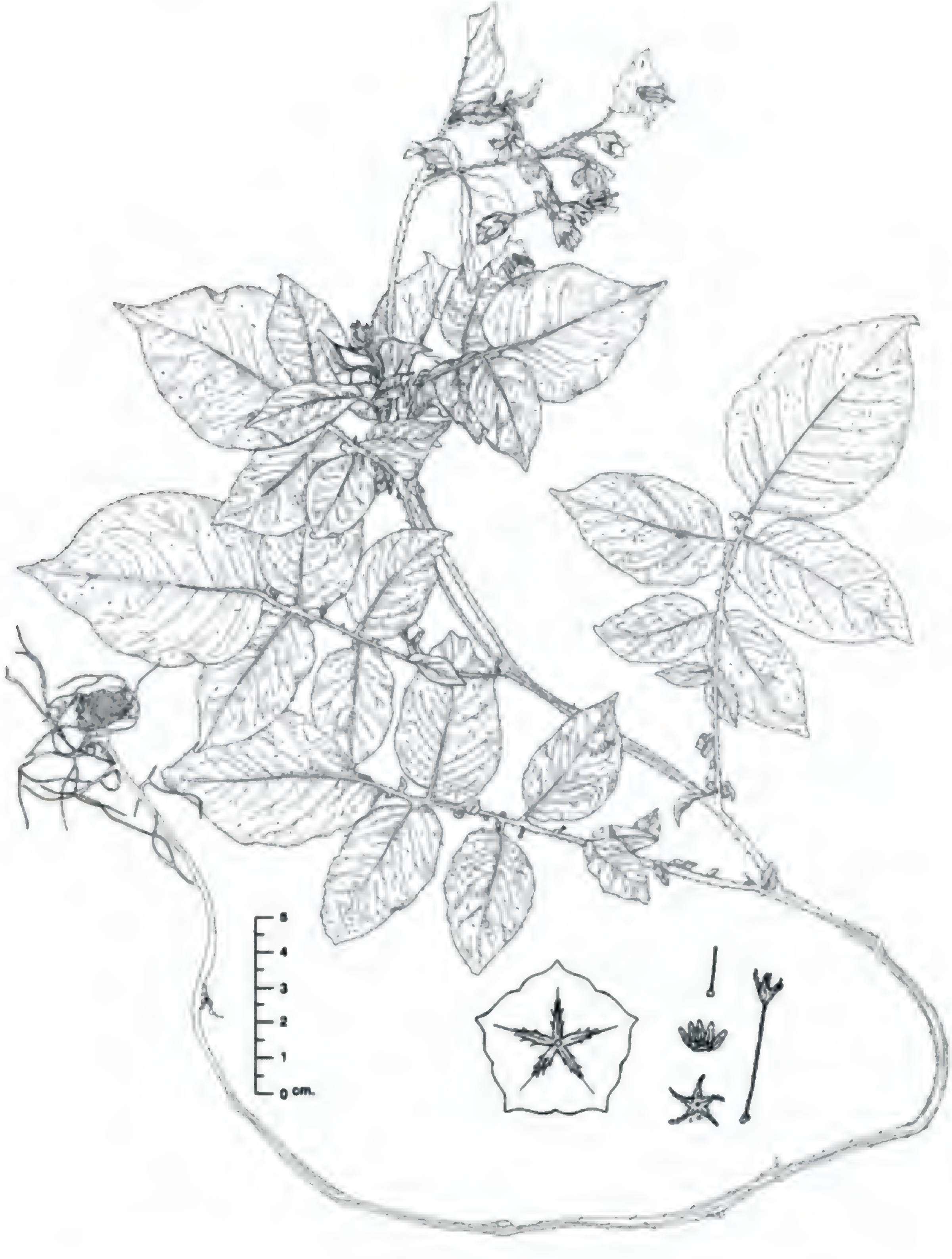


Figure 236. *Solanum* × *arahuayum* (*Vilcapoma 208*, holotype).

ther column asymmetrical, cylindrical-conical, anthers lanceolate, 6.0-6.5 mm long, orange-colored, base cordate; filaments 1.0-1.5 mm long with a few, very short interfilament hairs that are scarcely visible. Style 12-14 mm long, exerted 5 mm, densely papillose below center; stigma capitate, small. Ovary round. Fruit round, 1.5 cm in dia. Chromosome Number: 2n=24.

Type: PERU. Department Lima, Province Canta, Cruz Pallashcushca, 3100-3200 m alt., near Arahuay, among rocks, 28 March 1972, *G. Vilcapoma Segovia 208* (holotype Herbarium Ochoanum, isotypes MOL, OCH, UNTC, US, USM). Paratype: PERU. Department Lima, Province Canta, between Antaura and Huarhuaymarca, 2600-3000 m alt., 6 April 1979, *C. Ochoa 13257* (CIP, OCH, US).

Affinities

Solanum × *ayahuayum* has some characteristics in common with *S. wittmackii.* Both plants have cylindrical, wingless stems, and both are very similar with respect to the size and color of the corolla, size and shape of the calyx and the general pubescence of the plant. However, in *S.* × *arahuayum* the pilosity is less dense, the hairs are simple and much shorter with more sparsely distributed tetralobular glandular hairs, and the shape and dissection of the leaves are very different. However, other features of *S.* × *ayahuayum* are more similar to *S.*

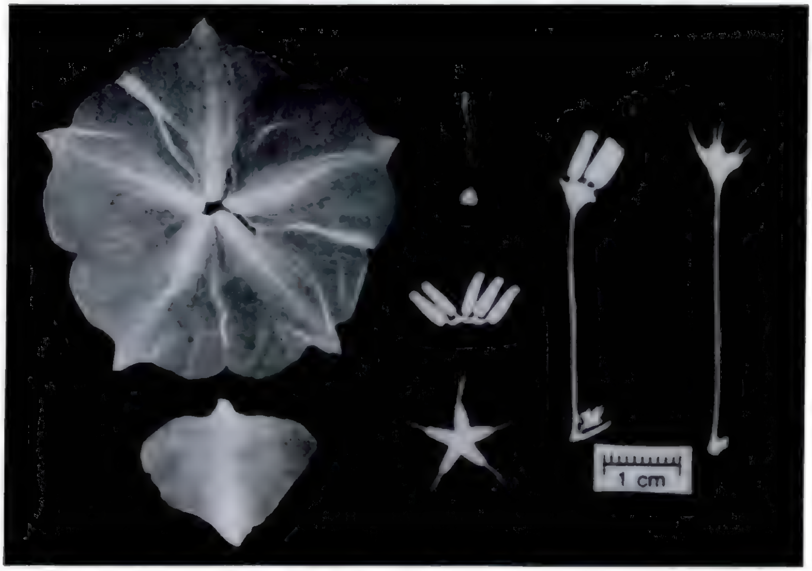


Figure 237. Floral dissection of *Solanum* × *arahuayum* (*Ochoa 11030*).

medians, including the small leaves having less than 4 pairs of lateral leaflets and a highly enlarged terminal leaflet. The intermediate morphology of *S.* × *ayahuayum* is in line with its suggested natural origin from a cross between *S. medians* and *S. wittmackii*.

Habitat and Distribution

This hybrid occurs in xerophytic quebradas of the western slopes of the central Andes. It is known currently only from the near vicinities of the villages of Anayca, Antaura, Huarhuaymarca and Arahuay in the Province of Canta, Department of Lima, where it grows at elevations ranging from 2650 to 3200 m alt. (Map 20).

Specimens Examined

Department Lima

Province Canta: Arahuay, Cruz de Pallashcushca, 3100-3200 m alt., near Arahuay, among rocks, 28 March 1972, *G. Vilcapoma Segovia 208* (UNTC, MOL, OCH, US, USM, type collection of *S.* × *arahuayum*). Between Antaura and Huarhuaymarca, 2600-3000 m alt., on steep xerophytic slopes on hard, dry and gravelly soils and among rocks, associated with *S. wittmackii*, *S. medians* and *S. hypacrarthrum*, 6 April 1979, *C. Ochoa 13257* (paratypes of *S. arahuayum* CIP, OCH, US). Near Anayca, 2650-2700 m alt., among large rocks, flowers lilac, large, January 1982, *C. Ochoa 11030* (CIP, MOL, OCH, US, USM) *ibidem*, from specimens grown in the greenhouse at Huancayo.

50. ***Solanum augustii*** Ochoa, Bol. Soc. Peruana Bot. 7(1-2):12-15,16, illustr., 1974.

Figs. 238-241; Map 20.

Plant erect to erect-ascending, (30-)60-70 cm tall, glabrescent; stem cylindrical, without wings, simple or branched, slender, 2-5(-7) mm in dia. at the base, dark green at the tips, marked with purple pigment along the basal two-thirds of its length, subglabrous or very sparsely pubescent; hairs short, white, multicellular; internodes (2.0-)3.5-7.0 cm long. Stolons to 1 m long, slender; tubers round to ovoid, subcylindrical or pyriform, whitish-yellow, small, 1-2 cm long (Fig. 241). Leaves long and narrow, (7.0-)13.0-19.5(-30.0) cm long by (4.5-)8.0-9.5(-10.5) cm wide, imparipinnate, with 4-5(-6) pairs of leaflets and 7-10(-16) pairs of interjected leaflets, dark green, glabrous or subglabrous and somewhat vernicose above, lighter green, opaque and glabrescent below, with some short tetralobular

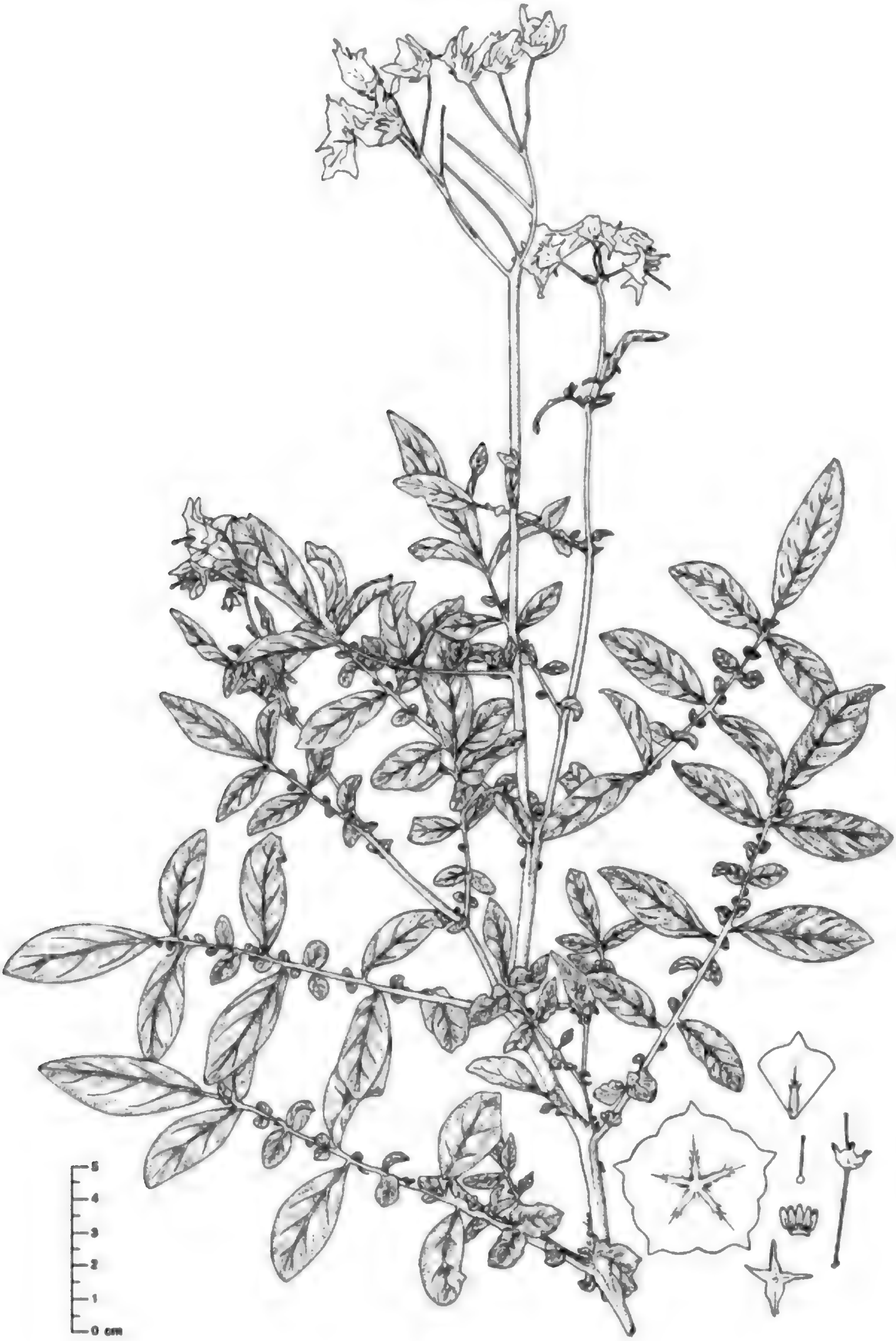


Figure 238. *Solanum augustii* (*Ochoa 3317*, holotype).

glandular hairs on the petioles and axils. Leaflets narrowly elliptic-lanceolate, the apex obtuse to subpointed, base rounded to obliquely rounded, subsessile or shortly petiolulate, petiolules 1-3 mm long, with or without acroscopic or basiscopic interjected leaflets. Terminal leaflet somewhat larger than the laterals, (3.5-)4.5-7.0 cm long by (1.0-)1.5-2.5 cm wide, base attenuate; leaflets of the first upper pair (3.0-)3.5-6.5 cm long by (0.9-)1.2-2.0 cm wide, usually with the base very narrowly decurrent about the rachis; leaflets of the second upper pair somewhat larger than the terminal leaflet and those of the first upper pair. Interjected leaflets of diverse size, from 1 mm to 10 mm long, orbicular, ovate or elliptical, the apex obtuse, sessile. Pseudostipular leaves falcate, 6-15 mm long by 3-7 mm wide. Inflorescence terminal, cymose or cymose-paniculate with 10-20 flowers; peduncle up to 12 cm long, forked 1-2 times, slightly pigmented, very sparsely pubescent; pedicels slightly pigmented, subglabrous, 20-30(-40) mm long, articulated 5.0-5.5 mm below the base of the calyx. Calyx asymmetrical or symmetrical, small, 5-6 mm long, glabrous; lobes elliptic-lanceolate, base broadly membranous and the apex narrowing to subspatulate or pointed acumens, 2.5-3.5 mm long. Corolla rotate to subpentagonal, 3.0-3.5(-4.0) cm in dia. (Figs. 238, 239), sky-blue or light-blue, internal star yellow-green or yellowish. Anther column conic-truncate, anthers broadly lanceolate, 5-6 mm long by 2 mm wide at base, puberulent, cordate on the dorsal side; filaments 0.5 mm long, glabrous. Style 10-11 mm long and long-exerted, sparsely papillose along the basal one-third of its length; stigma capitate, small, slightly enlarged at the apex of the style. Fruit round, 10-15 mm in dia., light green to green-glaucous with scattered white dots, not verrucose (Fig. 240). Chromosome Number: 2n=24. EBN=1.

Local Name: The inhabitants of the Cuesta del Mellizo call this plant *Atokkcha papan*; the fruits, however, are called *Coltuncha*.

Type: PERU. Department Ancash, Province Aija, Cuesta del Mellizo, 3000-3200 m alt., May 1972, *C. Ochoa 3317* (holotype OCH).

Affinities

Solanum augustii has certain features in common with *S. chomatophilum*. Both are similar in habit and in having cylindrical stems, ovate-elliptic to broadly elliptic leaflets, and leaves that are glabrescent and vernicose above. However, *S. augustii* differs from *S. chomatophilum* with respect to the color and size of its corolla, as well as in the position of its pedicel articulation. This species also has round berries and staminal filaments that are hairless.

Although similar in some important ways to *S. chomatophilum*, this species also appears to have strong links with *S. multiinterruptum*. It resembles the latter

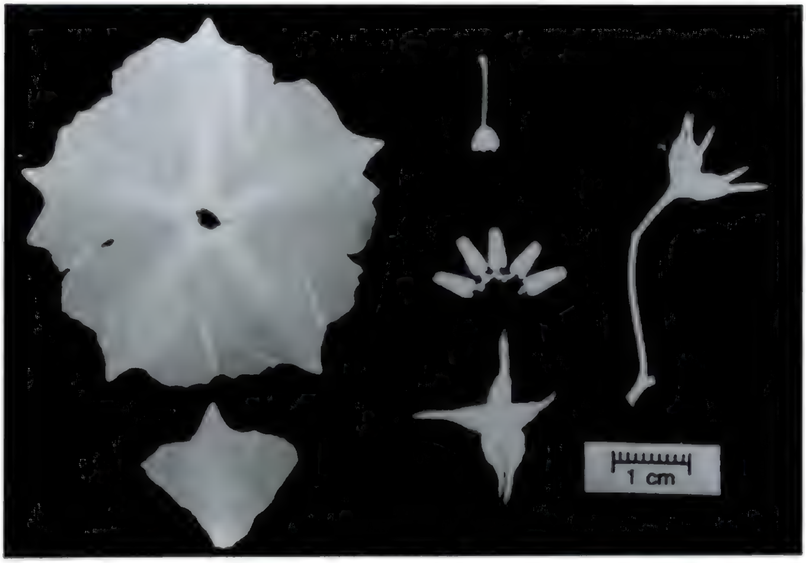


Figure 239. Floral dissection of *Solanum augustii* (*Ochoa and Salas* 15733).

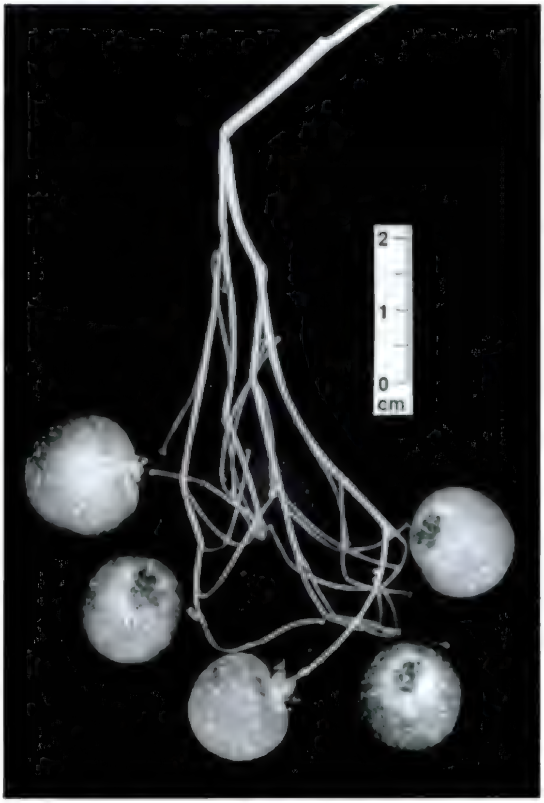


Figure 240. Fruits of *Solanum augustii* (*Ochoa and Salas* 15733).

species, for example, in the color and large size of its corolla, its long peduncles and strongly dissected leaves and pedicels that are articulated near the base of the calyx. Possibly, both *S. chomatophilum* and *S. multiinterruptum* were involved in the ancestry of this species. However, the long, narrow, strongly divided leaves of *S. augustii* and its dorsally puberulent anthers are features which tend to keep this rare plant distinct from most others.

Habitat and Distribution

Solanum augustii occurs in poor soils in *jalca* grasslands and on steep, rocky slopes in the high, cool interandean valleys of Peru. It is associated with spear grass (*Stipa* sp.) and various species of *Cajophora*, *Gentianella* and *Lupinus*, as well as with such other wild tuber-bearing species as *S. chomatophilum* and *S. multiinterruptum*.

At present, this species is known only from the Provinces of Aija and Huaraz in the Department of Ancash in northern Peru (Map 20), where it is found at elevations between 3000 and 3800 m.

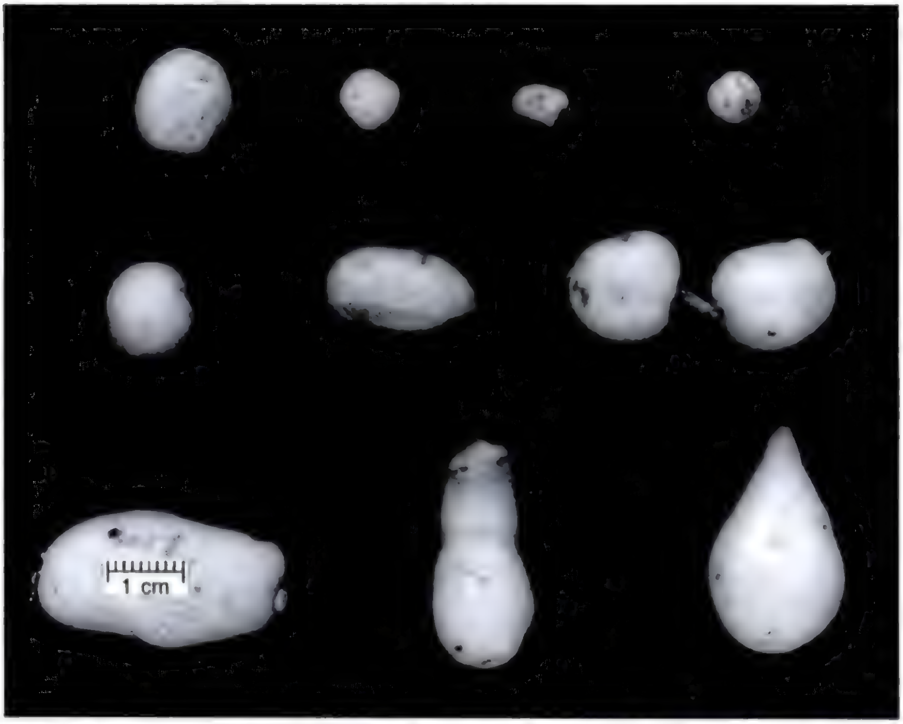


Figure 241. Tubers of *Solanum augustii* (*Ochoa and Salas 15733*).

Specimens Examined

Department Ancash

Province Aija: Cuesta del Mellizo, 3100-3200 m alt., walking upwards along the railroad line from Huayán to Aija, 2 May 1972, *C. Ochoa 3317* (OCH, type collection of *S. augustii*). Cuesta del Mellizo, 3200 m alt., along the footpath from Succhapata to Aija, corolla blue-sky blue, 24 April 1983, *C. Ochoa 15185*, 2n=24 (MOL, OCH, topotypes).

Province Huaraz: Chamlla, 3500 m alt., near Pampas, on moist rocky slopes, plants vigorous, 1 m tall, flowers pale lilac, almost white, large, 4 cm in dia., 9 June 1983, *J. Espejo Ruiz s.n.*, 2n=24 (OCH). District of Pampas, Cerro Canchón, 3800 m alt., in rock crevices near Huanchay, flowers sky-blue, June 1983, *J. Espejo Ruiz 007* (OCH). District of Pampas, Cerro Canchón, 3800 m alt., on grassy gravel slopes, plants 0.70 m tall, June 1983, *J. Espejo Ruiz 008 p.p.* (OCH). Chamlla, 3750 m alt., about 15 km northwest of Huanchay, between Huanchay and Pampas, plants 0.60-0.80 cm tall (very similar to var. *machaytambinum* of *S. multiinterruptum*), flowers light sky-blue, almost white, berries ovoid, 4 May 1984, *C. Ochoa and A. Salas 15733* (CIP, MOL, NY, OCH, US).

Natural Hybrids of *Solanum augustii*

In the *jalcas* of Chamlla in the Province of Huaraz (Department Ancash) are found large assemblages of wild potatoes that are made-up principally of *Solanum chomatophilum* and *S. multiinterruptum*, but which also contain naturally occurring hybrid swarms of these and other species. During one particular visit to this area, the author collected two hybrid forms (*OCH 15733B* and *15734*) that were growing alongside typical plants of *S. augustii* (*OCH 15733*) and *S. multiinterruptum* (*OCH 15733A*). The putative ancestries of these forms and their descriptions are as follows:

Solanum augustii × *S. chomatophilum ?*

Plant erect to semidecumbent, 70-90 cm tall. Stem slender, usually simple, without wings or very narrowly and inconspicuously winged. Leaves narrow, 16.0-22.5 cm long by 8.5-12.5 cm wide, with 4-5 pairs of lateral leaflets and 5-8 pairs of interjected leaflets. Leaflets glabrous above and glabrescent below, 4-6 cm long by 1.5-2.2 cm wide, narrowly elliptic-lanceolate with entire margins, pointed apex and shortly petiolulate base; the first upper pair narrowly decurrent about the rachis. Inflorescence 10-15-flowered. Pedicels 30-40 mm long, articulated 8-9 mm below the calyx. Corolla medium to large, 3-4 cm in dia., very light sky-blue.

Department Ancash, Province Huaraz, Chamlla, 3750 m alt., 15 km northwest of Huanchay, 4 May 1984, *C. Ochoa and A. Salas 15733-B* (CIP, OCH).

Solanum augustii × *S. multiinterruptum* ?

Plant very vigorous, 1.0-1.2 m tall. Stem 8-12 mm in dia. at the base, winged. Leaves long and narrow, 18-30 cm long by 9-13 cm wide, very divided, with 5-6 pairs of leaflets and many sessile interjected leaflets (18-22 pairs). Leaflets sparsely puberulent above and tomentose below, narrowly lanceolate, 4.6-5.5 cm long by 1-2 cm wide with acuminate apices and sessile or subsessile bases. Inflorescence cymose to cymose-paniculate, 15-20-flowered. Pedicels 30-40 mm long, articulated in the upper one-third of their length, or 10-11 mm below the base of the calyx. Corolla 3.5 cm in dia., light sky-blue with white acumens. Fruits ovate-conical, light green at the pointed apex, dark green at base, spattered with white dots, *i.e.* verrucose.

At the time of the above collection, the majority of the plants that were encountered by the author were past the flowering stage. However, some bore berries and had large, oval-flattened to ovoid tubers, these up to 10 cm long and weighing 180 g.

Department of Ancash, Province Huaraz, Iscupampa, 3750 m alt., approximately 1 km from Chamlla, 4 May 1984, *C. Ochoa and A. Salas 15734* (CIP, OCH, from plants reproduced from tubers in the greenhouse at Huancayo, 11 February 1985).

51. *Solanum aymaraesense* Ochoa, Phytologia 64(1):36-37, illustr., 1987.

Figs. 242-243; Map 19.

Plant erect-ascending to erect-decumbent, to 70-80 cm tall, sparsely pubescent; stem usually simple, slender, 6-8 mm in dia. at the base, glabrescent, light green, very narrowly and inconspicuously straight winged; internodes (5-)7-9 cm long. Stolons 1 m or more long; tubers round to ovoid, 2.5-3.5(-5.5) cm long, white with small lenticels, eyes small, semi-deep to deep. Leaves (13.0-)15.0-18.0 (-20.5) cm long by (7.5-)10.0-11.0(-13.0) cm wide, imparipinnate, with 4-5 pairs of leaflets and 2-5 pairs of interjected leaflets. Leaflets ovate apex obtuse, sparsely pubescent above including the rachis and the petiolules with very small tetralobular glandular hairs, especially in the leaf axils of the petiolules and leaves; leaflets

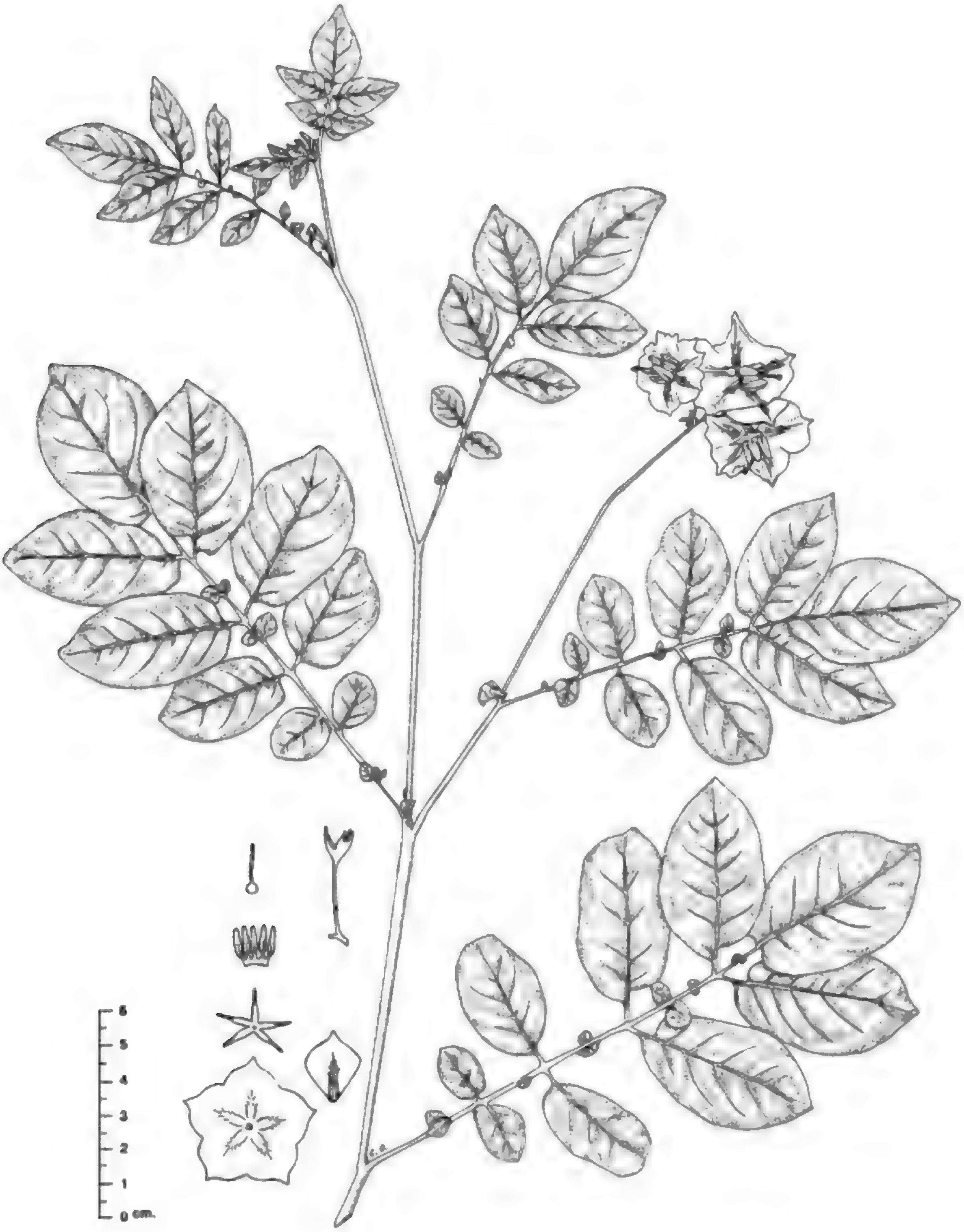


Figure 242. *Solanum aymaraesense* (*Ochoa 4150*, holotype).

not as pubescent below. Terminal leaflet 4.5-7.0(-8.0) cm long by 3.0-4.0(-4.5) cm wide, base obtuse, broadly rounded to subcordate; lateral leaflets with obliquely rounded base; petiolules short, 1.5-2.5 mm long; leaflets of the first upper pair slightly smaller than the terminal leaflet and nearly the same size as the leaflets of the second upper pair, 4-6(-7) cm long by 2.0-3.0(-3.5) cm wide, the remaining pairs of lateral leaflets diminishing gradually in size toward the base, the last pair of the lowermost leaf being considerably smaller and sessile. Interjected leaflets ovate to orbicular, small, sessile or decurrent about the rachis, 1.5-5.0 mm long. Pseudostipular leaves broadly falcate, small, 5-7 mm long by 3-4 mm wide. Inflorescence cymose or cymose-paniculate, 5-7(-12)-flowered; peduncles 9-10 cm long, slender, 1.5 mm in dia. at the base, densely puberulent as in the case of the pedicels and the calyx; pedicels 10-15(-20) mm long, articulated at the midpoint or more frequently below the midpoint, or about 7-10 mm below the base of the calyx. Calyx symmetrical or asymmetrical, 8-9 mm long, lobes narrowly lanceolate, the apex long-acuminate, acumens narrowly subspatulate or pointed, 2.5-3.5 mm long. Corolla rotate-pentagonal, usually small, 2.5-2.8 cm in dia. (Figs. 242, 243), pale violet to violet-lilac, the violet color darker within the internal star of the acumen. Anther column truncate-conical, asymmetrical; anthers lanceolate, 6 mm long, with a well defined dorsal groove, base distinctly cordate; filaments 0.5-1.0 mm long, white-hyalinous, glabrous. Style 10.5-11.5 mm long, exerted 2.5 mm, densely papillose along the lower two-thirds of its length; stigma small, ovoid, the apex obtuse. Fruit round, 10-15 mm in dia., usually green with 1-2 dark purple vertical stripes. Chromosome Number: 2n=24.

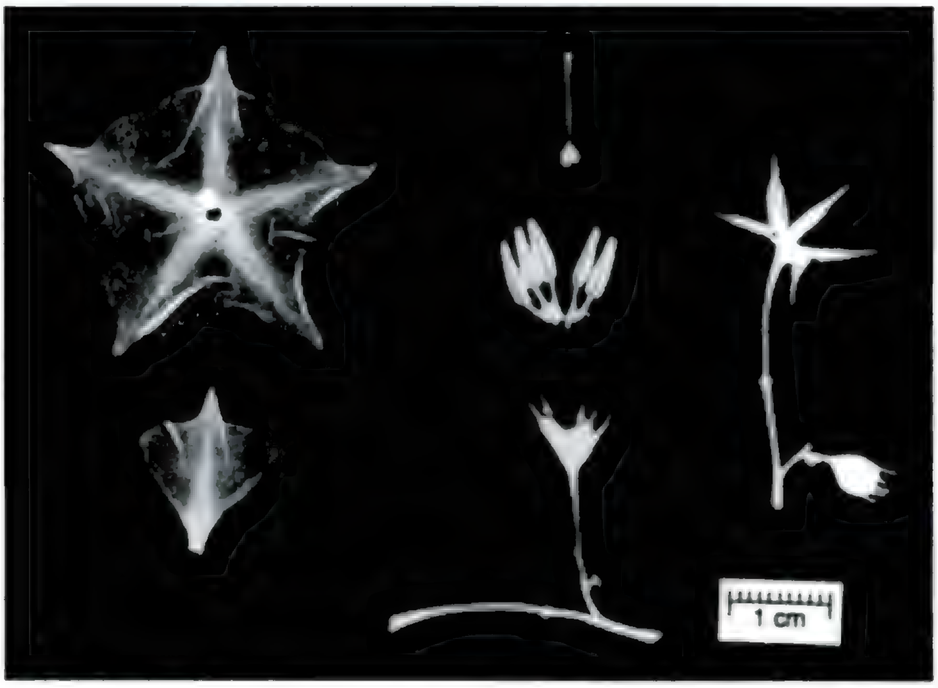


Figure 243. *Solanum aymaraesense*, floral dissection (*Ochoa 13810*).

Type: PERU. Department Apurímac, Province Aymaraes, vicinity of San Francisco, 2500 m alt., on rocky slopes, March 1973, *C. Ochoa 4150* (holotype OCH, isotype US).

Affinities

Solanum aymaraesense is closely related to *S. longiusculus*. Both are similar in habit, pubescence and corolla shape, and both have characteristically long internodes and peduncles. However, *S. aymaraesense* differs from that species by its fewer and more broadly ovate leaflets and by the position of its pedicel articulation, which is below center.

Although sharing many features in common with *S. longiusculus*, this species has leaves and leaflets that are strikingly similar to those of *S. multiinterruptum*. However, the leaves of *S. multiinterruptum* are much more divided than those of *S. aymaraesense*. Moreover, in *S. aymaraesense* the articulation of the pedicel is situated below the midpoint and the flowers are small, while in *S. multiinterruptum* the pedicel is articulated near the base of the calyx and the plant bears larger flowers.

Habitat and Distribution

Solanum ayamaesense grows in poor soils on rocky slopes at elevations from 2400 to 2600 m in the interandean valleys of Peru, where the climatic conditions are mild and temperatures are moderate. It is associated largely with grasses and various species of shrubs and herbs of the genus *Bidens*, *Calceolaria*, *Eupatorium* and *Monnina*, as well as with some non tuber-bearing species of *Solanum*.

This species is endemic to the Province of Aymaraes in the Department of Apurímac in southern Peru. Presently, it is known only from near its type locality (Map 19).

Specimens Examined

Department Apurímac

Province Aymaraes: Vicinity of San Francisco, 2500 m alt., March 1973, *C. Ochoa 4150* (OCH, US type collection of *S. aymaraesense*). Near San Francisco, 2550 m alt., only cuttings were collected, March 1980, *C. Ochoa 13810*, $2n=24$ (CIP, OCH, from plants propagated from cuttings in the greenhouse at Huancayo).

52. ***Solanum bill-hookeri*** Ochoa, Am. Potato J. 65(12):737-740, illustr., 1988.

Figs. 244-245; Map 20.

Plant 60-70(-120) cm tall, erect-ascending to erect-decumbent. Stem 6-8(-12) mm in dia. at the base, simple or little-branched, cylindrical or subcylindrical, usually without wings, glabrous or subglabrous, lightly marked with purple; internodes (5-)8-12(-16) cm long; stolons approximately 2 m long by 1.5-3.0 mm in dia.; tubers round, 2-3 cm in dia., white. Leaves short and broad, (7.5-)13.0-17.0(-21.0) cm long, including the petiole, by (6.5-)8.5-11.5(-14.0) cm wide, sparsely white pilose above with very short and adpressed hairs, somewhat more pubescent below, imparipinnate, with 3-4 pairs of lateral leaflets and 3-4(-6) pairs of interjected leaflets of 2-3 different sizes. Terminal leaflet elliptic-lanceolate, equal to or somewhat longer and wider than the adjacent laterals, (3.7-) 5.0-6.0(-7.5) cm long by (1.5-)2.5-3.0(-3.5) cm wide, the apex pointed, base broadly cuneate or rounded; lateral leaflets elliptic-lanceolate, the apex pointed, base asymmetrically rounded, on petiolules 3-4(-7) mm long; the first pair of lateral leaflets 3.0-4.0(-5.8) cm long by 1.0-1.7(-2.2) cm wide. Pseudostipular leaves broadly falcate or asymmetrically ellipsoidal, the apex obtuse, 8-12(-14) mm long by 6-7(-9) mm wide. Inflorescence cymose, 8-15(-20)-flowered. Peduncle 7-14 cm long by 2.0-2.5 mm in dia. at the base, sparsely and shortly pilose as in the case of the pedicels and the calyx; pedicels 15-20(-25) mm long, articulated near or slightly above the midpoint, or 7-9 mm below the base of the calyx. Calyx symmetrical or asymmetrical, 7 mm long; lobes rectangular-lanceolate with the apex abruptly narrowing to pointed or narrowly subspatulate acumens, 1.5-2.0 mm long. Corolla rotate to rotate-pentagonal, 2.5-3.0 cm in dia. (Figs. 244, 245), blue, with white acumens on the outside and a grayish-white internal star. Anthers 6.5-7.0 mm long, narrowly lanceolate, base cordate; filaments 1.0-1.5 mm long, glabrous. Style 10-11 mm long, sparsely papillose along the basal one-third of its length, exerted 2.5 mm; stigma capitate. Fruit round to ovoid, light green, 1.5-1.8 cm long. Chromosome Number: 2n=24.

Type: PERU. Department Huancavelica, Province Tayacaja, Kkaratu-way'ko, ca. 2900 m alt., March 1973, *C. Ochoa 4295* (holotype OCH, isotypes F, GH, US).

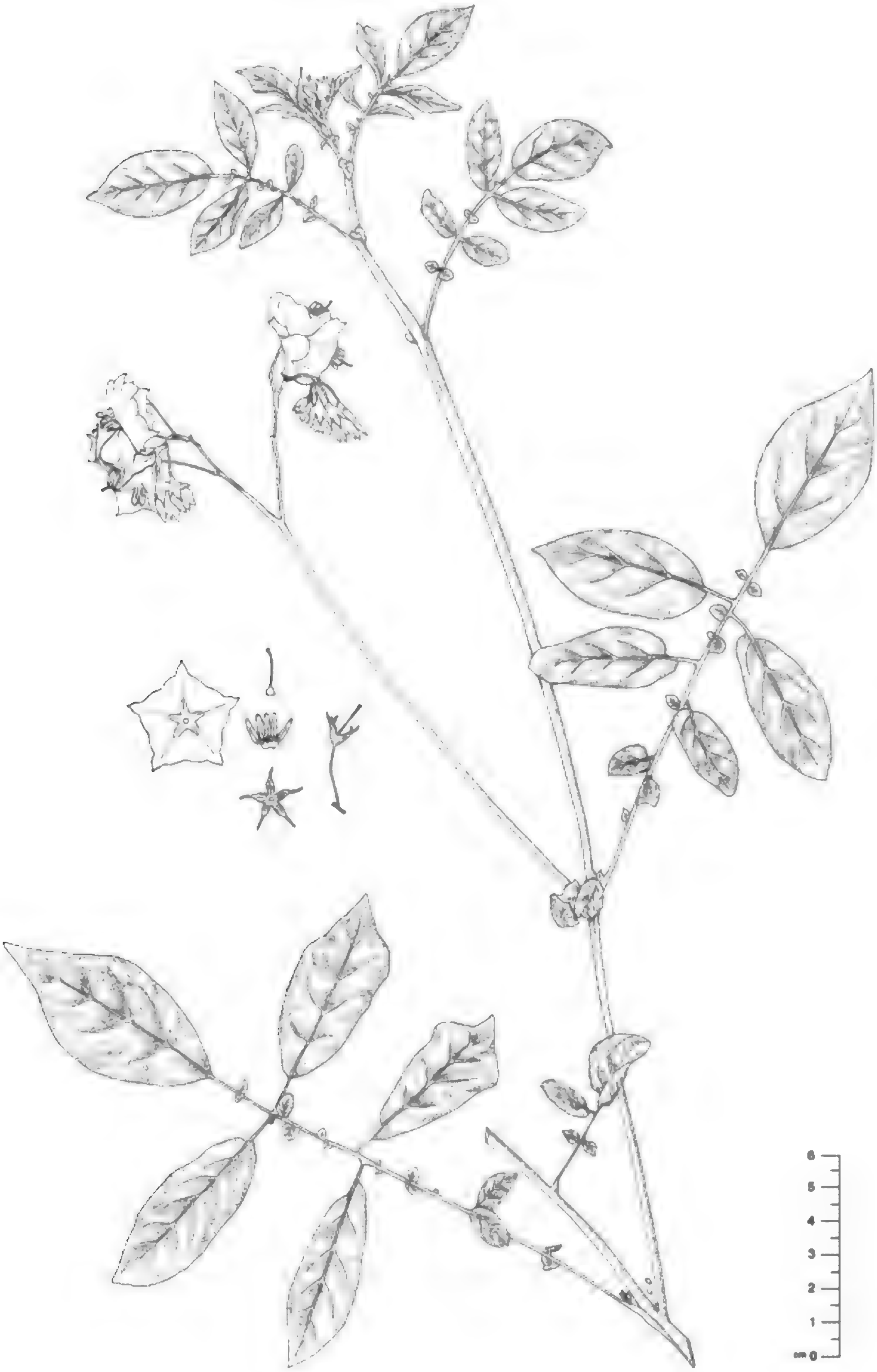


Figure 244. *Solanum bill-hookeri* (*Ochoa 4295*, holotype).

Affinities

So far as is presently known, *Solanum bill-hookeri* is wholly unique in its characteristics and, as such, appears to have little relationship with any other wild tuber-bearing species of *Solanum*. The habit of the plant and the shape and segmentation of its leaves, as well as the shape of its leaflets and the characteristics of its calyx and corolla, make this species entirely unmistakable.

Habitat and Distribution

Solanum bill-hookeri grows in an arid region in poor, clay-like or rocky soils. It often occurs with various pasture grasses and plants of *Verbena* beneath the protective spiny branches of *Opuntia exaltata*, as well as other cacti. However, its survival in this area of live-stock ranching is today being threatened by the pressures of over-grazing. It may be that this species is on the road to total extinction, and that its present area of distribution is as small as it really appears.

The known distribution of *S. bill-hookeri* is limited to two neighboring localities in the Province of Tayacaja in the Department of Huancavelica in central Peru, where it occurs at elevations of 2900 and 3200 m (Map 20).

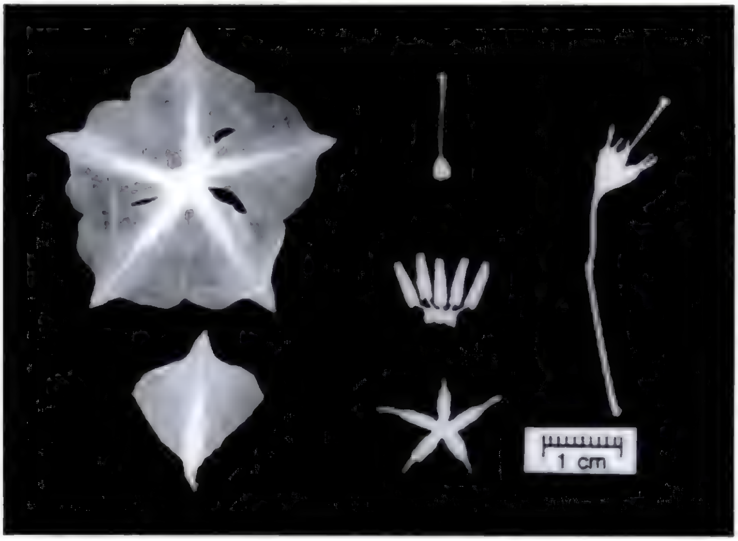


Figure 245. Floral dissection of *Solanum bill-hookeri* (*Ochoa 4295*, holotype).

Specimens Examined

Department Huancavelica

Province Tayacaja: Kkaratu-way'ko, ca. 2900 m alt., among columnar cacti and in rocky soils, March 1973, *C. Ochoa 4295* (F, GH, OCH, US, type collection of *S. bill-hookeri*) and (OCH, from plants propagated in the fields at Huancayo). Fraile Huayjo, 3200 m alt., January 1985, *C. Ochoa and J. Amaya 15915* (paratypes CIP, OCH, US).

Breeding Potential

This self incompatible species has been used as a pistillate parent (*OCH 15915*) in unilateral crosses involving *S. bukasovii* (*11851*) and *S. sparsipilum* (*15522*). The average number of seeds obtained for each hybrid cross was, respectively, 20 and 30 per berry.

53. *Solanum bukasovii* Juz., Bull. Acad. Sci. U.S.S.R. 2:303, 1937.

Figs. 246-260; Map 22; Plate XXIV.

S. kaufmanii Buk., *nom. nud.* Bull Acad. Sci. U.S.S.R. ser. Biol., 715. 1938; Sov. Pl. Ind. Rec. 4:13. 1940, the description was based on plants grown near Leningrad from tubers collected by *M. Kaufman s.n.* in K'ayra, Cusco, Peru in November 1928 (WIR).

S. abbottianum Juz, Bull. Acad. Sci. U.S.S.R. ser. Biol. 2:305-306, 1937. Type: *Abbott s.n.,* Peru, Department Junín, near Jauja, 1935 (WIR, plants grown near Leningrad, Russia in 1936, from original seed collected by Abbott and sent to Russia via Donald Reddick of the USA).

S. canasense Hawkes var. *latifolioum* (Vargas) Ochoa, *Los Solanum Tuberíferos Silvestres del Perú*:170-175, Fig. 88, Lima. 1962. Type: *Vargas 609,* Department and Province Cusco, Chacán, north of Cusco, 3700 m alt., November 1936, based on the type of *S. lechnoviczi* var. *latifolium* (CUZ, LL).

S. lechnoviczii Hawkes var. *latifolium* Vargas, *Las Papas Sudperuanas*, Publ. Univ. Nac. Cusco 2:61 Fig. 18, 1956. Type: *Vargas 609* (CUZ, LL, OCH).

S. canasense Hawkes, Bull. Imp. Bur. Pl. Breed. Genet. Cambridge 47, 123, Figs. 35-36. 1944. Type: *Vargas 2001*, Peru, Department Cusco, Province Canas, [near] Puente Asunción, [above the river] Apurímac, 3800 m alt. (CPC, CUZ, K, from plants grown in fields at Cambridge, England from original seed given by the collector).

S. pumilum Hawkes, Bull. Imp. Bur. Pl. Breed Genet., Cambridge 47, 124, Fig. 37. 1944. Type: *Vargas 9839 p.p.*, Peru, Department Cusco, Province Canchis, Sicuani, 3750 m alt., 24 February 1939 (CPC, CUZ, F, OCH, US). Basionym of *S. sicuanum*.

S. sicuanum Hawkes, *The Potato*, p. 148, Belhaven Press, Pinter-Publishers, London. 1990. Type: The same as *S. pumilum* Hawkes.

S. punoense Hawkes, Bull. Imp. Bur. Pl. Breed. Genet., Cambridge 47, 123, Fig. 34. 1944. Type: *Balls and Hawkes 6620*, Peru, Department and Province Puno, [Hacienda] Ilpa, 3800 m alt., 23 April 1939 (CPC, UC).

S. canasense Hawkes var. *lechnoviczii* (Hawkes) Ochoa, *Los Solanum tuberíferos Silvestres del Perú*: 168, Fig. 85, Lima. 1962. Type: *Balls and Hawkes 6770* (CPC, K).

S. lechnoviczii Hawkes, Bull. Imp. Bur. Pl. Breed. Genet. Cambridge 49, 124, Fig. 39. 1944. Type: *Balls and Hawkes 6770*, Peru, Department Cusco, Province Quispicanchi, near Oropesa, Racchchi, 4000 m alt., 24 May 1939 (CPC, K).

S. soukupii Hawkes, Bull. Imp. Bur. Pl. Breed. Genet., Cambridge 46, 122, Fig. 33. 1944. Type: *Balls and Hawkes 6667*, Peru, Department and Province Puno, Granja Taller School of Puno, 3850 m alt., 25 April 1939 (CPC, K).

S. ochoae Vargas, *Las Papas Sudperuanas*, Publ. Univ. Nac. Cusco 2:62-63, Fig. 21. 1956. Type: *Vargas 4067*, Peru, Department and Province Cusco, Chacán, north of Cusco, 3600 m alt., 27 January 1944 (CUZ, LL).

S. canasense Hawkes var. *calcense* Vargas, *Las Papas Sudperuanas*, Publ. Univ. Nac. Cusco 2:58, Fig. 11. 1956. Type: *Vargas 4074*, Peru, Department Cusco, Province Calca, Quebrada Kochoc, 2900-3000 m alt., 21 February 1944 (CUZ).

S. canasense Hawkes var. *intihuatanense* Vargas, *Las Papas Sudperuanas*, Publ. Univ. Nac. Cusco 2:58, Fig. 12. 1956. Type: *Vargas 5065*, Peru, Department Cusco, Province Calca, Pisac, Intihuatana, 3400 m alt., 20 March 1945 (CUZ, LL).

S. amabile Vargas, *Las Papas Sudperuanas*, Part. II Publ. Univ. Nac. Cusco: 2:58, Fig. 13. 1956. Type: *Vargas 5958*, Peru, Department Cusco, Province Urubamba, between Peñas and Kosñiriti, 3700 m alt., 23 March 1946 (CUZ, LL).

S. canasense Hawkes var. *alba* Vargas, *Las Papas Sudperuanas*, Publ. Univ. Nac. Cusco 2:57, Fig. 10. 1956. Type: *Vargas 7836*, Peru, Department Cusco, Province Urubamba, Pumahuanca, 4300 m alt., in a rocky area, 14 February 1949 (CUZ, LL).

S. espinarense Vargas, *Las Papas Subperuanas*, Part II, Publ. Univ. Nac. Cusco 2:60, Fig. 16. 1956. Type: *Vargas 10573*, Peru, Department Cusco, Province Espinar, Hacienda Pokera, 4500 m alt., 14 February 1952 (CUZ, LL, OCH).

S. soukupii Hawkes var. *espinarense* (Vargas) Ochoa, *Los Solanum Tuberíferos Silvestres del Perú*, p. 278, Fig. 151, Lima. 1962. Type: The same as *S. espinarense* Vargas.

S. abancayense Ochoa, Ann. Cient. Univ. Nacl. Agraria, Lima, 1(2):134-137, 1963. Type: *Ochoa 2267*, Peru, Department Apurímac, Province Abancay, along the route Cachora-Huanipaca, 20 February 1960 (OCH).

S. antacochense Ochoa, American Potato J. 58(3):127-129, 1981. Type: *Ochoa 3587*, Peru, Department Junín, Province Concepción, between Ututo and Antacocha 3480 m alt., February 1973 (OCH).

S. hapalosum Ochoa, Bol. Soc. Argentina Bot. 22(1-4):297-299. 1983. Type: *Ochoa 3891*, Peru, Department Lima, Province Yauyos, between Peroyda and the right bank of the Pucayacu River, 3340 m alt., March 1983 (OCH).

Plant rosette-forming or subrosette-forming at base, at times essentially acaulescent, erect or weakly ascending, bushy, usually small or low, (7-15-)25-40(-60) cm tall, densely and finely pubescent; stem simple or branched, straight or slightly flexuous with decurrent lines or narrowly winged, pigmented or slightly pigmented, purple, sparsely pilose, hairs long white subadpressed; internodes (0.3-)1.5-2.5(-3.5) cm long (Fig. 256). Stolons 70-150 cm long; tubers oval compressed or round to ovoid, 3-6 cm long, whitish to light brown, with superficial or semi-deep eyes and very long brows, flesh very white. Leaves imparipinnate frequently rosette-forming at base of the plant, (2.5-4.0-)13.0-22.0(-26.5) cm long by (1.5-4.0-)5.5-8.0(-12.5) cm wide, with (2-3-)4-5(-6) pairs of lateral leaflets and (0-1-)2-5(-6) pairs of interjected leaflets, densely pilose on both sides, hairs fine and unequally long, 1-2 mm, white or yellow. Leaflets elliptic or broadly elliptic-lanceolate or broadly ovate, apex obtuse or pointed, base broadly rounded or slightly cordate or sometimes oblique, the lateral leaflets subsessile to shortly petiolulate, occasionally on petiolules to 4 mm long, sustaining one to several secondary interjected leaflets. Terminal leaflet broadly ovate-elliptic to suborbicular, apex pointed or shortly acuminate, larger or slightly larger than the the laterals, (1.0-)2.5-6.0(-8.0) cm long by (0.5-)1.5-3.5(-5.5) cm wide. The first pair of lateral leaflets (0.5-)1.5-4.0(-6.5) cm long by (0.3-)0.5-2.0(-3.0) cm wide. Interjected leaflets of diverse size, from 1 to 14 mm long, orbicular or suborbicular, ovate or broadly elliptic, sessile. Pseudostipular leaves narrow and asymmetrically elliptic or semielliptic to falcate, 5-12 mm long. Inflorescense terminal or subterminal, cymose-paniculate, 3-17-flowered; peduncle robust, cylindrical, bifurcate, erect, nearly always rising above the upper part of the stem,

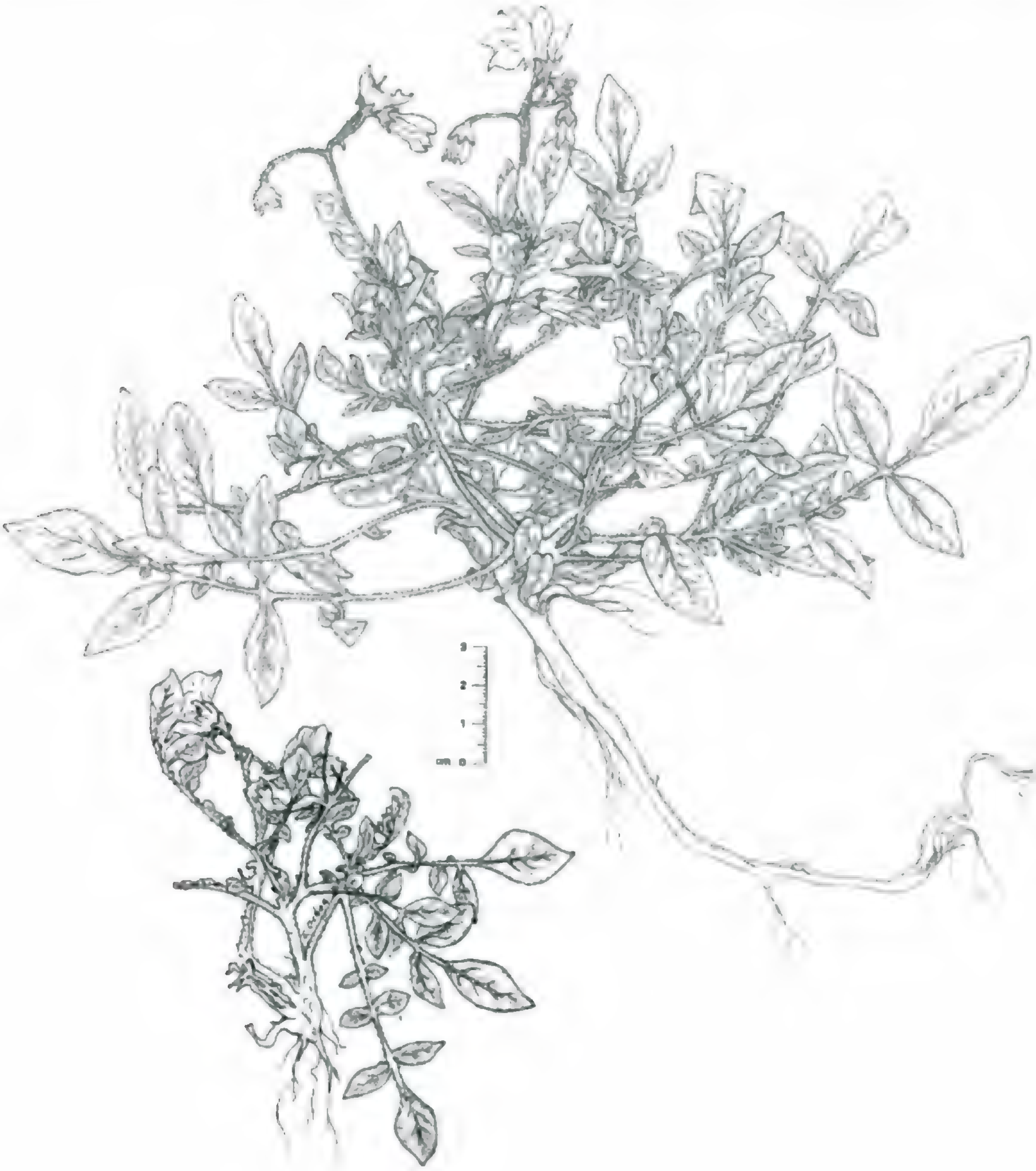


Figure 246. *Solanum bukasovii* (*Juz. 10605*, lectotype).

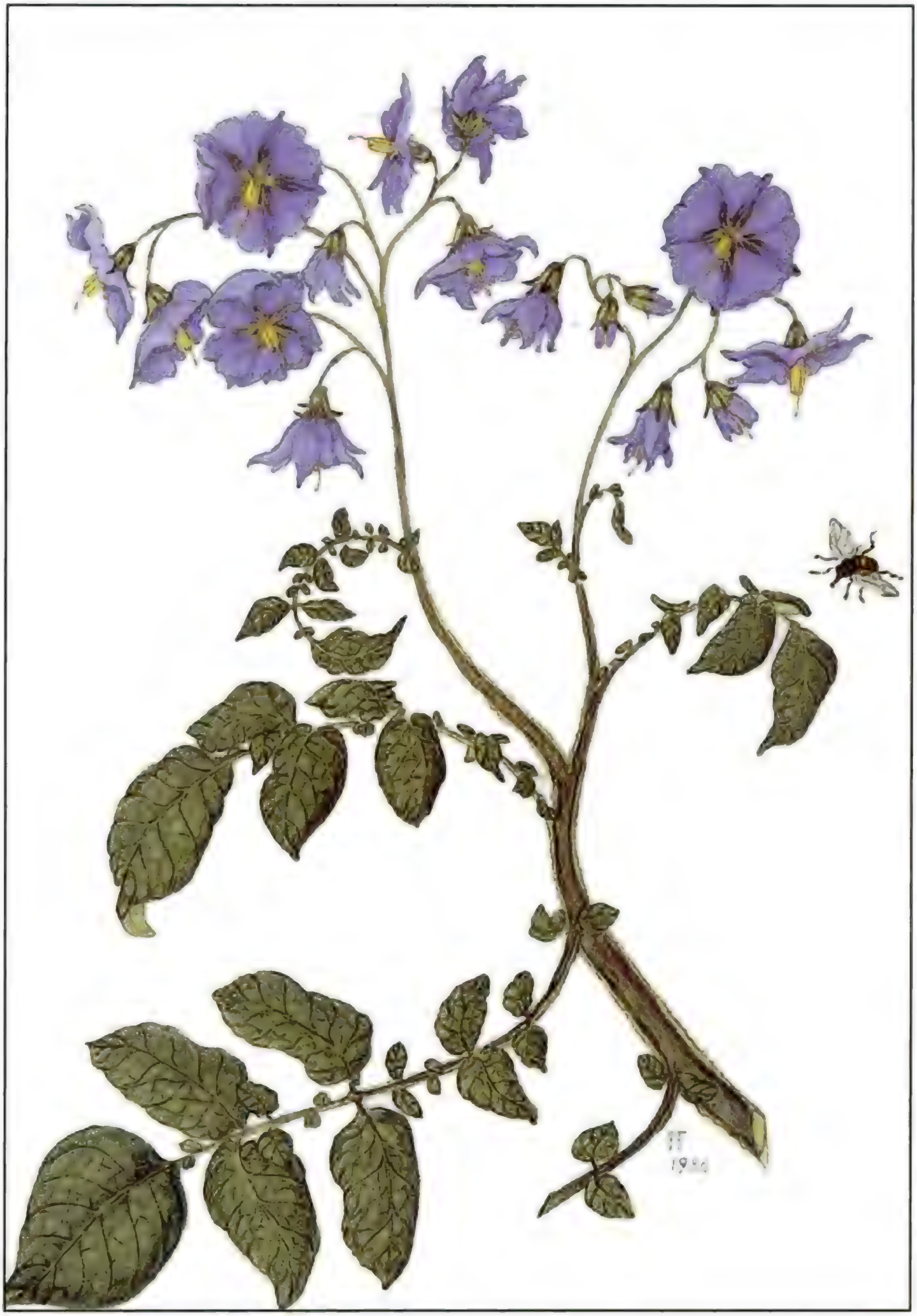


Plate XXIV. *Solanum bukasovii* Juz.

(4-)10-18 cm long by (1.5-)2.0-3.0 mm in dia. at the base, pigmented, densely pubescent and sparsely provided with short glandular hairs, as in the case of the pedicels; hairs multicellular, white, pointed and fine, pedicels slender, 15-30 (-40) mm long, articulated above the midpoint or about 4-5(-6) mm below the base of the calyx. Calyx symmetrical or asymmetrical, 7-10 mm long, pigmented, pubescent, densely pilose mixed with glandular hairs, lobes broadly elliptic-lanceolate to ovate-lanceolate, somewhat rhombic, broadly scarious at base, mucronate or abruptly acuminate, acumens short, 1.0-1.5 mm long. Corolla broadly rotate pentagonal to rotate, showy and usually large, (2.8-)3.5-4.5(-5.0) cm in dia. (Figs. 249-251), blue-violet to deep purple or violet and very rarely white, with prominent suborbicular lobes, usually long or abruptly narrowed to triangular acumens, pointed, finely puberulent externally, similar to the middle part of the lobes. Anthers lanceolate, 6.0-7.5 mm long; filaments 1.5-2.5 mm long, glabrous. Style 10-11 mm long, exerted 3-4 mm, densely papillose along the basal two-thirds of its length; stigma subglobose, apex obtuse and base emarginate, slightly enlarged at the apex of the style. Fruit broadly ovoid or subglobose, 2-3 cm long, green with vertical purple-violet stripes (Figs. 254, 255). Chromosome Number: 2n=24. EBN=2.

Local Names: *Jupay Papa* (=Devil's Potato) in Cerro de Pasco; *Pishu Akshu* (=Bird Potato) in Jauja; *Arakk Papa* (=Wild Potato) or *Atokk Papa* (=Fox Potato) in the Provinces of Canchis and Quispicanchis, Cusco.

Type: PERU. Department Junín [Department Pasco, Province Pasco], Yanamactachay [Yanamachay] near city of Cerro de Pasco, on the bank of a river, among rocks and along the edges of a cultivated area, 7 March 1927, *S. Juzepczuk 10605* (LE lectotype, here designated; OCH, isotype, from plants grown at Leningrad, Russia, from seeds originally collected at Yanamachay).

With respect to the possible role this species has played in the origin of the cultivated potato and its genetic potential so far as the improvement of the potato is concerned, *S. bukasovii* ranks as an extremely important species. However despite this, a clear definition of the taxonomic position of *S. bukasovii* within Series Tuberosa (including its relationship to other species) has been late in coming. This was due in part to the fact that the original diagnosis of this species and *S. abbotianum* by Juzepczuk was based on plants that were grown under long day conditions at Puskin, the latter near Leningrad [today St. Petersberg], Russia (about 59°55' N and 30°15' E), and not far from the arctic circle. Similarly, the diagnoses of *S. canasense*, *S. multidissectum* and *S. soukupii* that were made by Hawkes were based on plants that were grown in the northern hemisphere at Cambridge, England (approximately 52°13' N and 0°08' E). This explains why the type col-

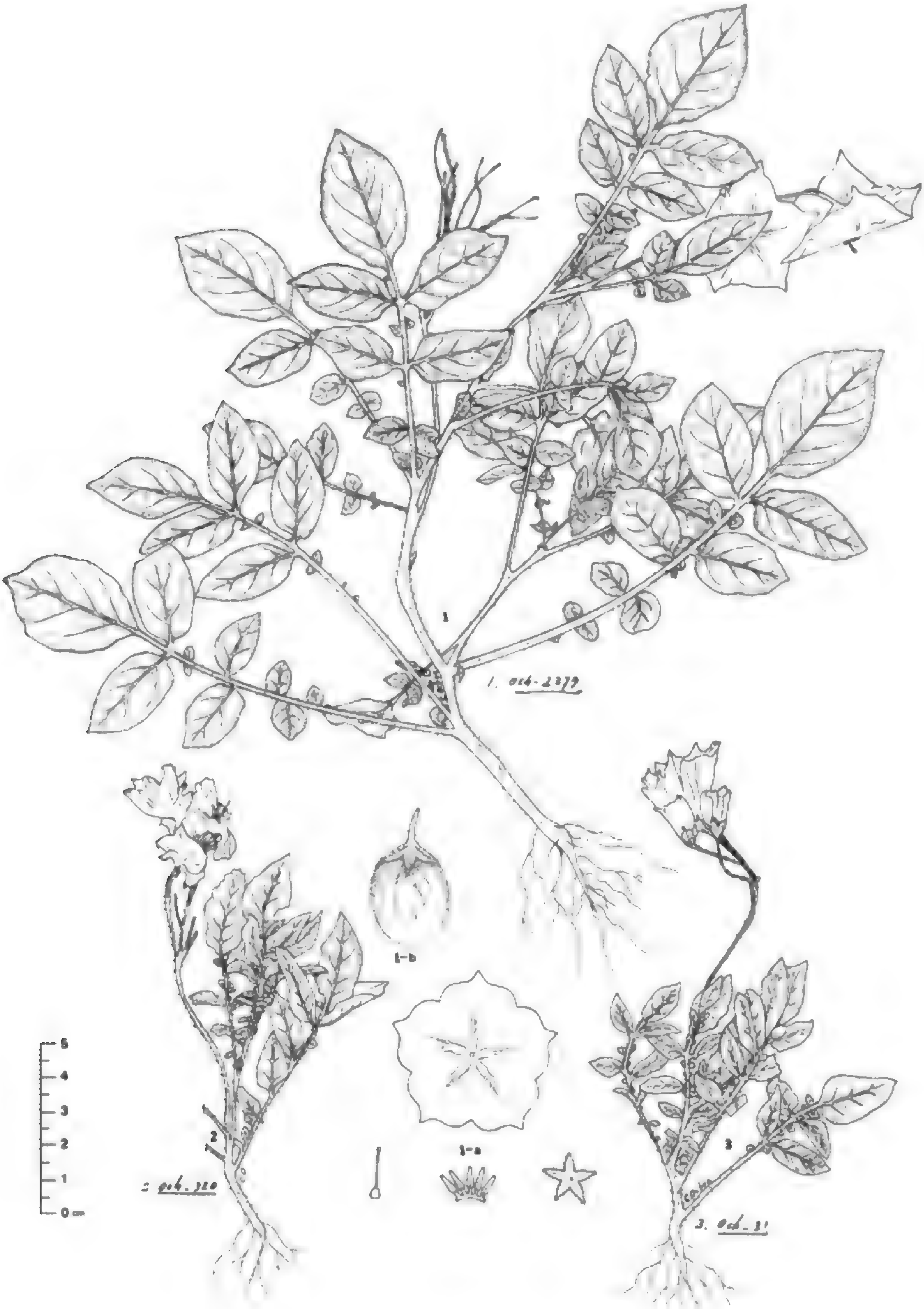


Figure 247. Topotypes of *Solanum bukasovii* (Plant 1: *Ochoa, 2379* Plant 2: *Ochoa 320*, Plant 3: *Ochoa 31*).

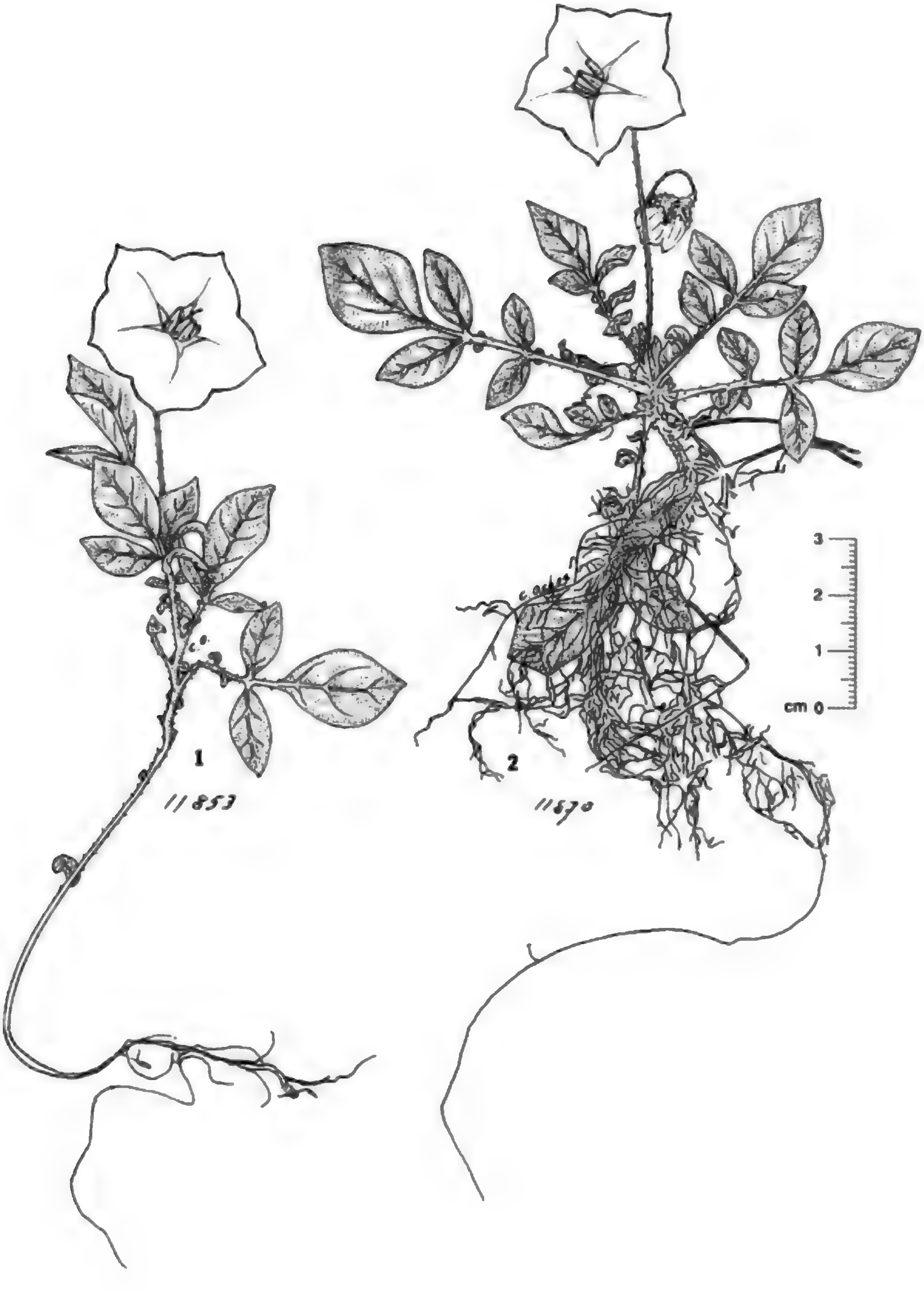


Figure 248. *Solanum bukasovii*, showing very small plants:
1. *Ochoa 11853*, collected at Tahualtuco, 3600 m alt., Concepción, Junín.
2. *Ochoa 11870*, collected at Huaytapallana, 3700 m alt., Huancayo, Junín.

lections of the above mentioned species, and particularly of the morphologically very similar *S. bukasovii* and *S. canasense*, are different in appearance from the plants found in the original localities of these species (topotypes) which develop under the short day conditions found near the equator. Moreover, as the above authors had few specimens at their disposal, they were not aware of the full range of biotypes that occur in nature.

As might be expected from a species having a very broad geographic distribution that encompasses a number of ecologic zones, *S. bukasovii* is morphologically extremely variable. For example, plants of this species when growing on high plains or escarpments at elevations between 3700 and 4300 m, are usually very small and rosette-like to acaulescent. These high altitude forms of *S. bukasovii* are surprisingly similar in habit to *S. acaule*, but, of course, can be told apart from that species by their differing floral characteristics. One high altitude form of this species that was collected by Vargas (No. *10037*; CUZ, LL) from the plains of El Descanso, Canas, Cusco, was actually identified as *S. acaule* by Correll (1962; p. 340).

However, other variant forms of *S. bukasovii* appear at slightly lower elevations (3700-3300 m) throughout its extensive range in Peru, this stretching from the Departments of Moquegua and Puno in the south to Ancash and Huánuco in the north (or 10°32' S and 76°02' W to 15°50' S and 70°01' W). Within its larger territory, plants of *S. bukasovii* vary tremendously according to altitude and habitat conditions. At one extreme are plants having well developed glabrescent stems, few if any rosette leaves, poorly dissected leaves, large leaflets and large corollas; while at the other extreme are plants having densely pubescent, small to medium-sized stems having many basal rosette leaves, highly dissected stem leaves, small leaflets and corollas that can range from small to medium or even large. Examples of localities sheltering different biotypes of *S. bukasovii* include the deep and narrow Canyon of Cerro de Pasco-La Quinua (the type locality of this species), the high plains of La Raya-Juliaca-Puno and Canas-Espinar-Cusco, the broad valleys of La Raya-Sicuani-Cusco in southern Peru and the Mantaro (Jauja-Huancayo) and Pampas River Valleys in central Peru.

One feature of *S. bukasovii* that appears to be subject to more environmental plasticity in this species than in any others is the size of the corolla. Thus, plants of this species that develop in the sunny, open areas of the high steppes or *puna* grasslands of Peru are typically small flowered, bearing corollas that average usually no more than about 2.8 cm in diameter; whereas other plants of this species when growing in this same general habitat but in the shade of taller plants, or in the shade of large rocks or tufts of *Stipa ichu*, characteristically develop much larger flowers, often in the neighborhood of 3.5-4.0 cm in diameter. Large-flowered shade forms of *S. bukasovii* are known from the highlands of Jauja (3500-

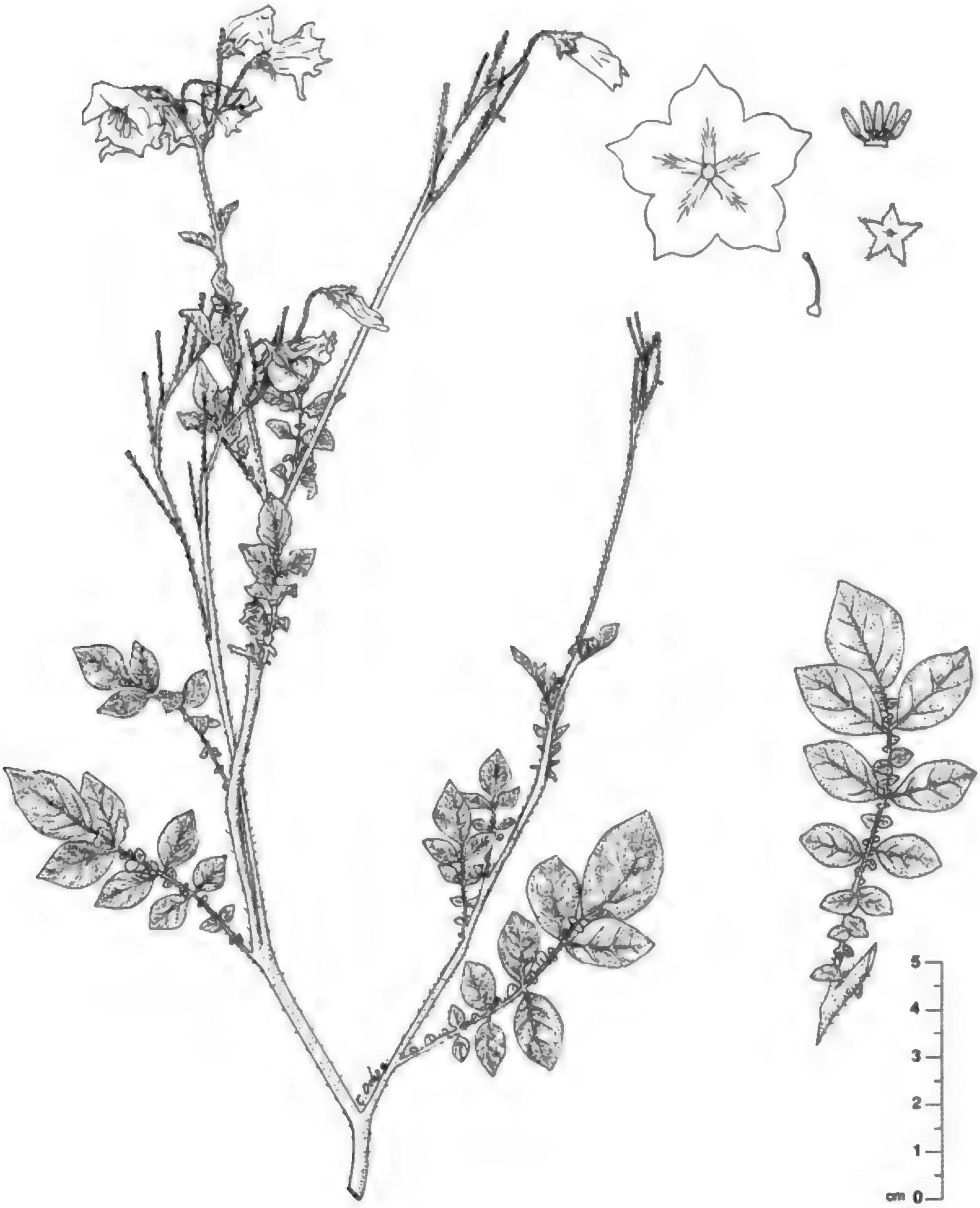


Figure 249. *Solanum bukasovii* (*Ochoa 11876*), collected in the vicinity of Jauja, 3450 m alt., Junín, near the type locality of "*S. abbotianum.*"

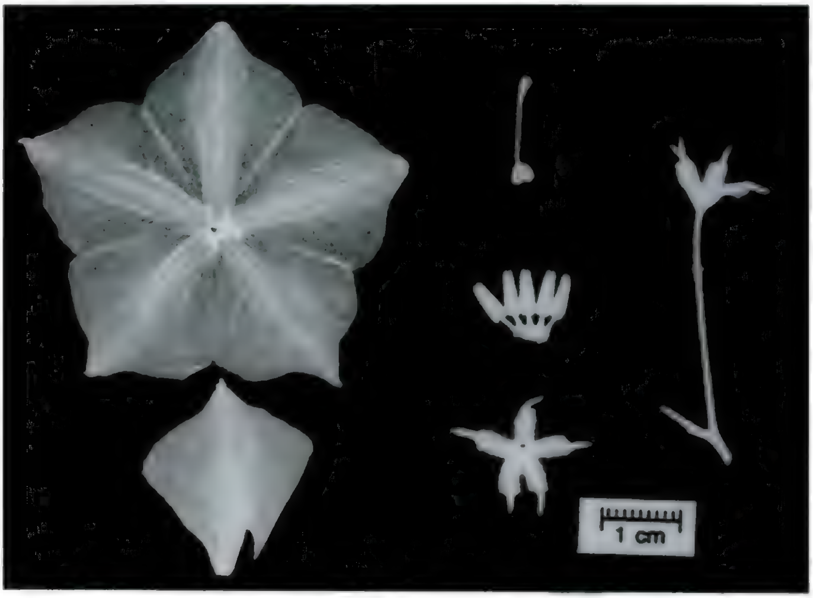


Figure 250. Floral dissection of *Solanum bukasovii* (*Ochoa 13862*), collected at Lloclla, 3800 m alt., near the type locality Yanamachay, Pasco.

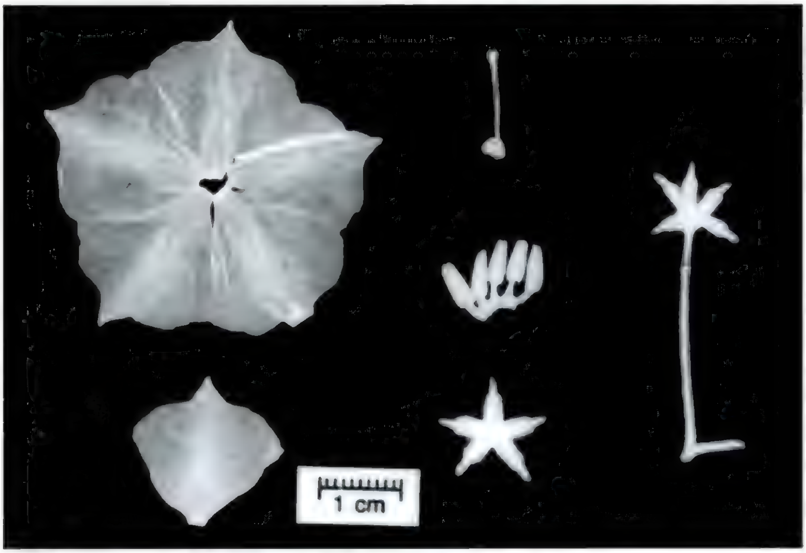


Figure 251. Floral dissection of *Solanum bukasovii* (*Ochoa 14333*), collected at Chuñunapampa, 3800 m alt., distr. Cachora, Abancay, Apurímac.

3600 m alt.) and grasslands in the vicinity of Hacienda Casablanca (4000 m alt.), both Department of Junín in central Peru. A similar phenomenon was observed among plants of *S. bukasovii* growing at somewhat lower elevations in quebradas at Concepción (3200 m alt.) and Quichuay (3300 m alt.). In both places, plants having showy corollas 4.5 cm or more in diameter were found growing abundantly under trees of *Polylepis* or in the shade of *Alnus* along irrigation canals. However, when large-flowered plants of this type are grown in the open under more or less uniform experimental field conditions (including collections of *S. bukasovii*, *S. abbotianum*, *S. canasense*, *S. multidissectum* from various localities and habitats), there is a notable reduction in the range of variation of the flowers. Most have corollas that are fairly uniform in appearance and very similar to those of *S. bukasovii*. Only very occasional plants produce larger flowers, and then not nearly to the extremes that are found in nature.

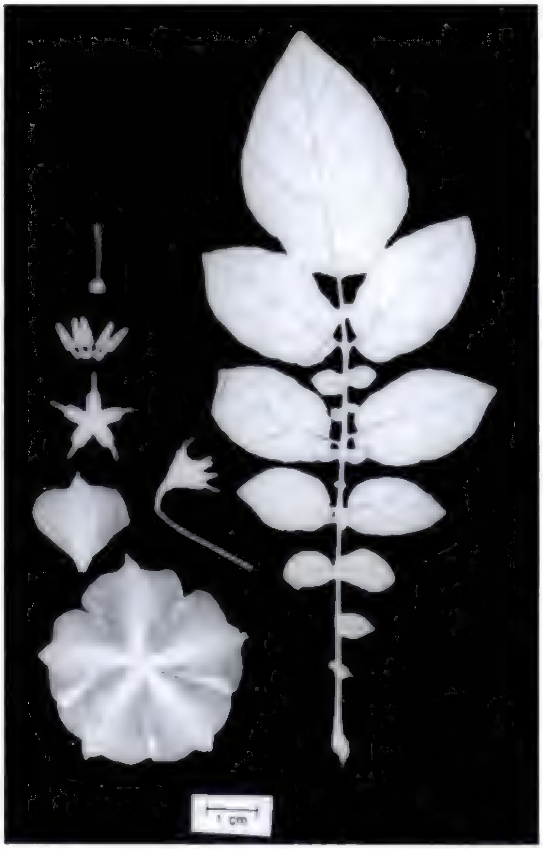


Figure 252. Floral dissection and leaf of *Solanum bukasovii* (*Ochoa 13859*), collected at Carmen Chico, 3900 m alt., Yanamachay, near the type locality of the species.

Also of interest is the fact that certain collections of this species from near La Raya, Dept. Puno (*OCH-13523* and *13524*) and Yauyos, Dept. Lima (*OCH-2603*) yield plants with white corollas when propagated from tubers at CIP, while others grown from seeds that originated from plants collected at Rajchi-San Pedro, Cusco (*Hjerting, Cribb and Huamán 5087 =PI473347*) or Yanamachay (*OCH-11295*), the type locality of *S. bukasovii*, produce segregate types, yielding some plants that are white flowered and others that have a deep blue-violet corolla. Moreover, the same collections when massively sown in the open field (but reproduced originally under greenhouse conditions at La Molina or Huancayo), yield plants that have more greatly divided leaves and larger stems and flowers than is usual for the species.

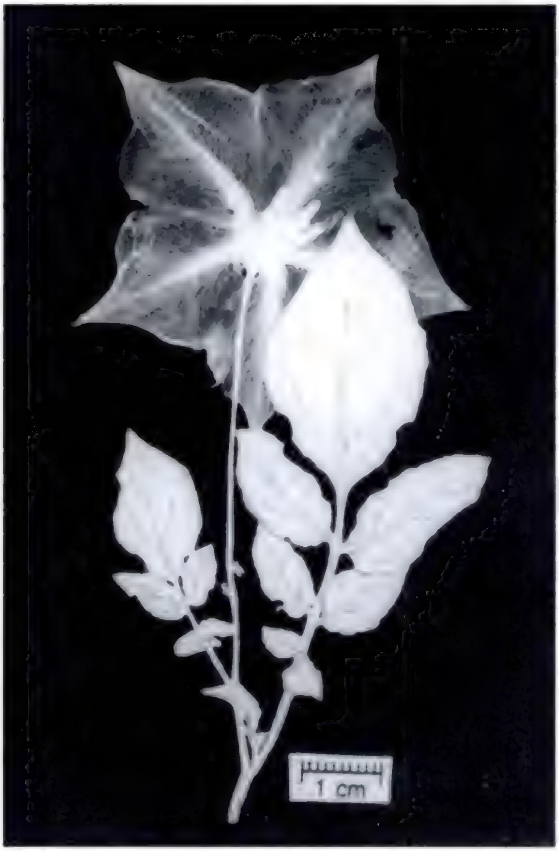


Figure 253. *Solanum bukasovii* (*Ochoa 2379*), showing a very small plant with its typically large flower, collected at Yanamachay, the type locality of the species.

Affinities

This species has ties with several others in this series, including *S. leptophyes*, *S. sarasarae*, *S. achacachense* and *S. brevicaule*. It approaches *S. leptophyes* most closely in habit and in the general pubescense of the plant, but differs from that species in many other important respects. For example, in *S. bukasovii*, the stem and peduncles are thicker and more robust, and these are covered more densely with fine, silky hairs rather than with coarse hair as found in *S. leptophyes*. Moreover, *S. bukasovii* differs from *S. leptophyes* in having more highly dissected leaves, broader leaflets, a consistently higher pedicel articulation and a larger and more broadly rotate-pentagonal corolla that terminates in very long lobes.

With regard to *S. sarasarae*, the two species are largely similar with respect to their vegetative characteristics. Both species are endowed with strongly dissected leaves that are borne upon fairly low-growing stems, but which are only occasionally rosette-forming. It differs principally from *S. bukasovii* in having a very small, rotate corolla and in developing very small berries that are almost always globular.

Solanum bukasovii has several characteristics in common with the Bolivian species *S. achacachense*, including a robust habit and the tendency to form occasional rosettes, as well as a high pedicel articulation and medium-sized corolla. It is also related to the Bolivian species *S. brevicaule*. The two are similar in having stems that are divided into short internodes and in having nearly identically-shaped

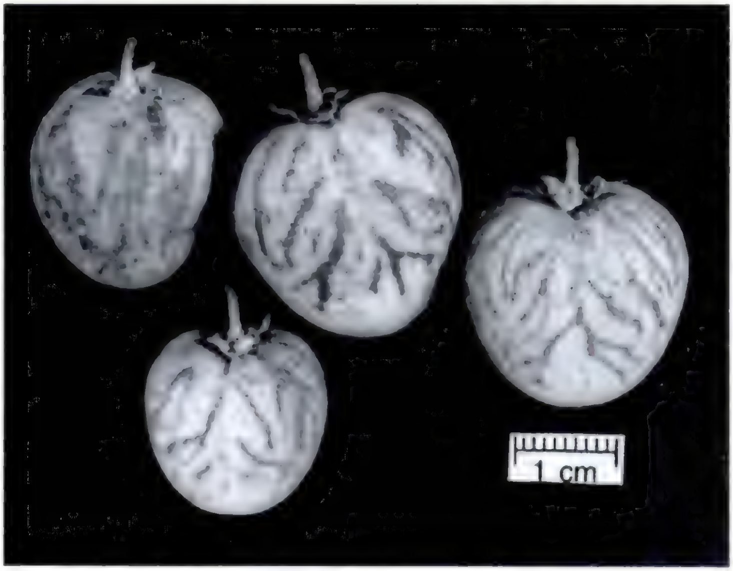


Figure 254. Fruits of *Solanum bukasovii* (*Ochoa 13190*).

leaflets. However, *S. brevicaule* differs from *S. bukasovii* in having pedicels that are articulated closer to the midpoint and in having thicker, coarser and more scale-like hairs over the entire plant.

Habitat and Distribution

Solanum bukasovii is essentially a species of the high Andes of Peru. Although the altitudinal range of this species lies between 2000 and 4000 m, less than 20 collections of the more than 800 examined for this study were collected at elevations between 2000 and 2950 m alt.; whereas, more than 600 came from areas situated between 3500 and 4400 m, and about 160 from areas located between 3000 and 3400 m.

Throughout its broad range, this species grows on a variety of different soil types, ranging from soils rich in organic matter to clay soils, sandy-clay soils, sandy-rocky soils and calcareous soils. It is often found along the banks of streams, and along roadsides, trails and the margins of cultivated fields. It has also been collected from talus slopes along highways, rocky slopes and the foothills of mountains, rocky-muddy fields, manured soils and grasslands.

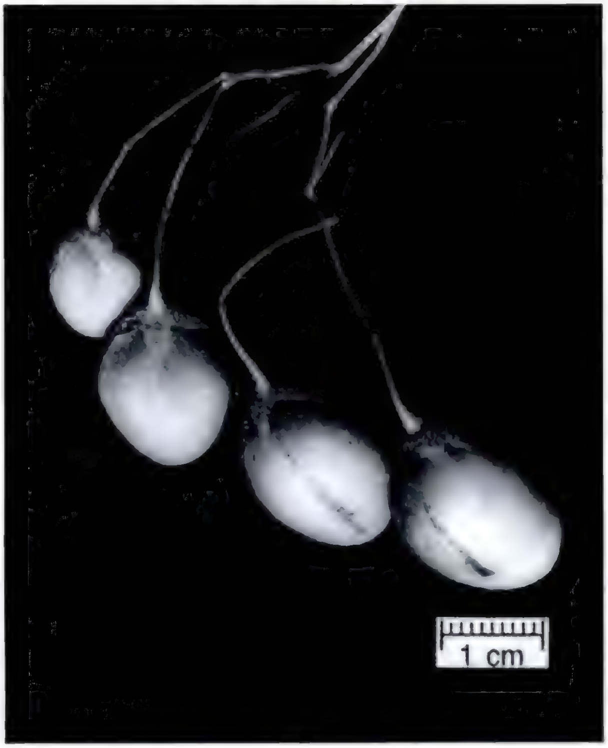


Figure 255. Fruits of *Solanum bukasovii* (*Ochoa 13684*).

The natural vegetation that accompanies this wild potato species throughout its range is also varied. At Yanamachay, which is the type locality of *S. bukasovii* [today renamed Carmen Chico], this species occurs in a rocky, high and narrow quebrada situated in the Cañón Cerro de Pasco-La Quinua (3500-4000 m alt.), where it grows with *Stipa ichu* and a few scattered patches of *Astragalus* sp. and *Lupinus* sp. On the other hand, on the high, open plains or steppes of Peru, such as occur at Santa Rosa, Juliaca and in the vicinity of Puno or in the Provinces of Canas, Espinar and Chumbivilcas in the Department of Cusco, this species is almost always associated with *S. acaule*, *Alternanthera*, *Cajophora*, *Plantago*, *Lobivia* and various members of the grass family, such as *Stipa*, *Festuca*, *Muhlenbergia* and *Poa*, among others. And, in quebradas formed by escarpments, as in the vicinity of Lambrama in the Province and Department of Apurímac, this plant grows in the shade of such relic forest trees as *Eugenia omissa* and *Escallonia resinosa*. In the vicinity of La Quinua, in Pasco, it occurs under the few scattered trees of *Polylepis* that remain in the area. At Rinconada de Quichuay, near Concepción in the Department of Junín, *S. bukasovii* grows in shrubby thickets comprised of *Cantua*, *Berberis*, *Mutisia*, *Spartium*, *Cassia* and *Eupatorium*, as well as in *Polylepis* forests or under trees of *Eucalyptis* and *Alnus*. However, at still other localities in the vicinity of Concepción, *S. bukasovii* occurs in open fields along with plants of the genus *Loasa*, *Bomarea*, *Verbena*, *Medicago* and

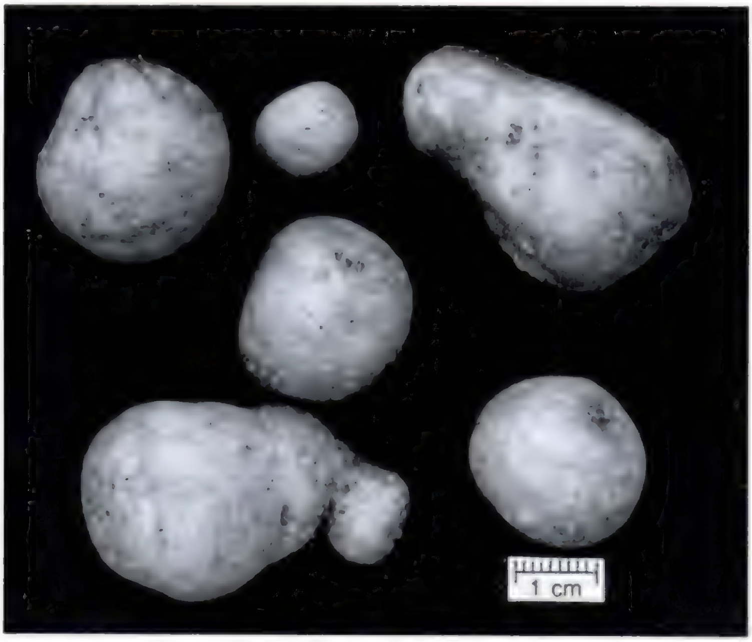


Figure 256. Tubers of *Solanum bukasovii* (*Ochoa 13559*).

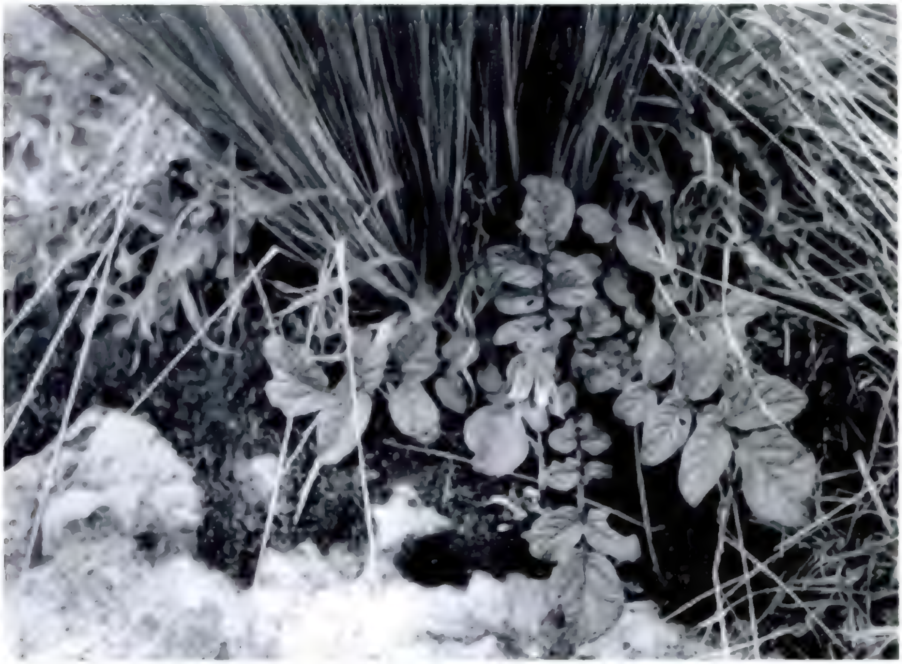


Figure 257. *Solanum bukasovii,* near Yanamachay (today Carmen Chico), Pasco, its type locality, growing under the protection of *Stipa ichu* and in melting snow. Photo: C. Ochoa, 1984.

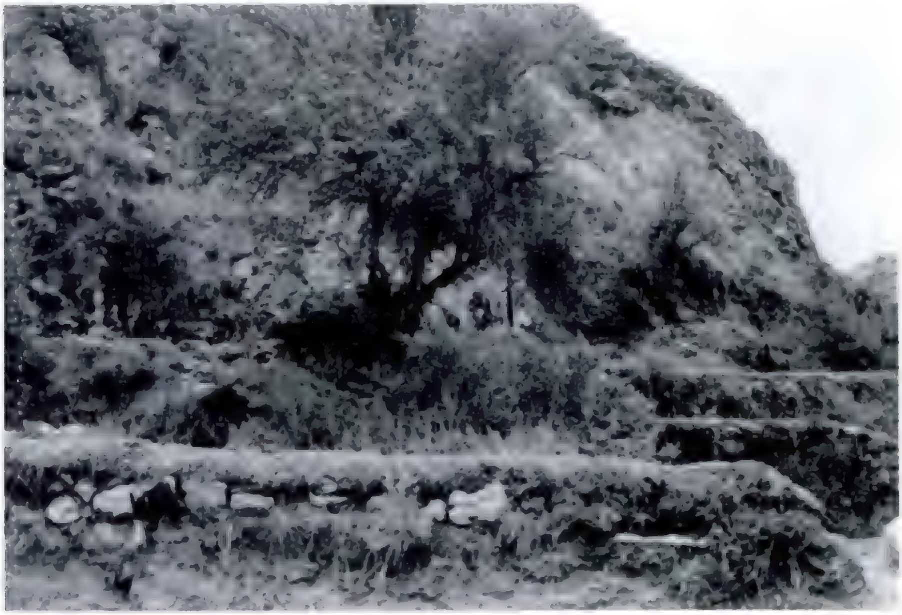


Figure 258. *Solanum bukasovii,* facing Yanamachay (today Carmen Chico), 3800 m alt., Pasco, its type locality and habitat.

Plantago. It has also been collected from moist fields near Tambomachay, Cusco, where it grows with *Bacharis*, *Barnadesia*, *Castilleja*, *Epilobium*, *Opuntia* and various composites and grasses. However, in the lower, drier areas of its range, as in the vicinity of the lagoon near Huacarpay, Cusco, *S. bukasovii* occurs with *Nicotiana glauca*, *Erdisia squarrosa* and various species of bromeliad and salvia. Lastly, at elevations between 2500 and 3000 m in the interandean valleys of Huasaloma-Candamo (Arequipa) and Ayacucho-Chiara, *S. bukasovii* occurs with small trees of *Schinus molle*, a grass of the genus *Cortaderia* and various herbaceous plants, including species of *Briza*, *Chenopodium*, *Opuntia*, *Bidens*, *Calceolaria*, *Oenothera*, *Salvia*, and others.

Geographically, the range of this species takes in the *jalcas* of the Departments of Ancash and Huánuco in northern Peru; the *punas* and extensive interandean valleys of the Departments of Pasco, Junín, Lima and Huancavelica in central Peru; and, the Departments of Ayacucho, Apurímac, Cusco, Arequipa, Moquegua and Puno in southern Peru. All together, its distribution stretches from 08°34' S and 77°54' W to 16°46' S and 70°41' W (Map 22). It is possible that the range of this species might also extend just across the border into northwest Bolivia.

Solanum bukasovii occurs on both sides of the cordillera in central Peru and on the cis-Andean side of the western quebradas, as, for example, at Cañón del Rimac, as well as at other places. It also occurs on the western side of the Andes

Figure 259. *Solanum bukasovii*, near Yanamachay [or Cueva Negra] (today Carmen Chico), 3800 m alt., Pasco. Photo: C. Ochoa, 1984.

near Chilca (3600-3700 m alt.), in the Department of Lima. From that high point the range dips downward to 2500 m near San Mateo, but never quite reaches the coast. Similarly, in the southern part of the Department of Arequipa, *S. bukasovii* (as represented by *OCH 5106* and *14275*) occurs at high elevations from the villages of Chivay and Shibayo (*ca.* 4000 m alt.) on the eastern side of the cordillera in the Province of Cailloma to much lower elevations (2000-2500 m alt.) along the cis-Andean side of Arequipa (see collections by Guenther and Tidow, Nos. *1402*, *1405*, *1409* and *1414*; HBG).

Specimens Examined

Department Ancash

Province Corongo: Cerro Clarín, 3200 m alt., between Corongo and Aco, above Aco, 3-6 May 1978, *C. Ochoa 13000*, 2n=24 (CIP, F, GH, MOL, NY, OCH, US).

Department Apurímac

Province Abancay: Above Lambrama, 3200 m alt., on rocky hillsides, 22-23 February 1960, *C. Ochoa 2218* (OCH). About 15 km from Lambrama, heading up the Lambrama-Chuquibambilla road, 3500 m alt., with *Stipa ichu*, on a rocky

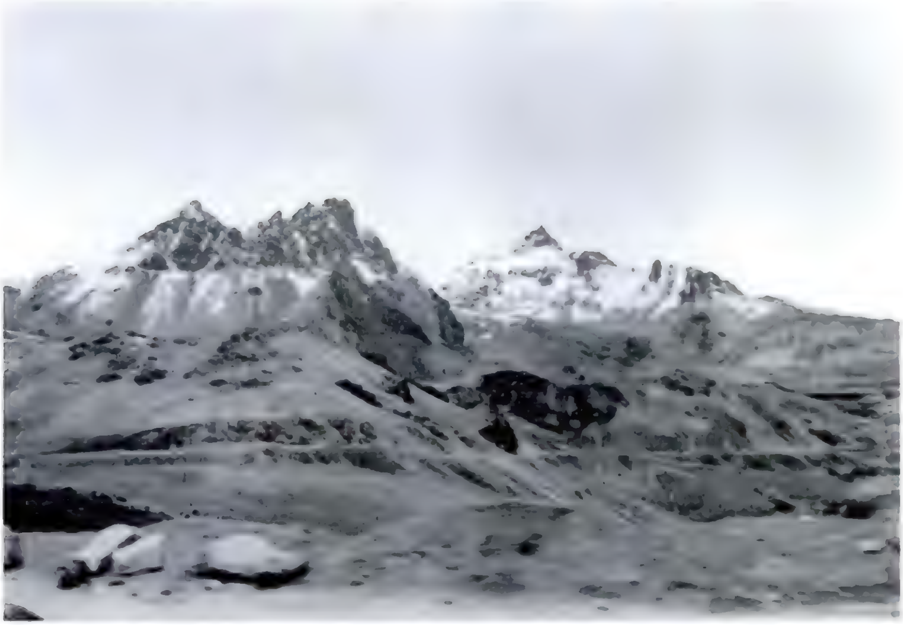
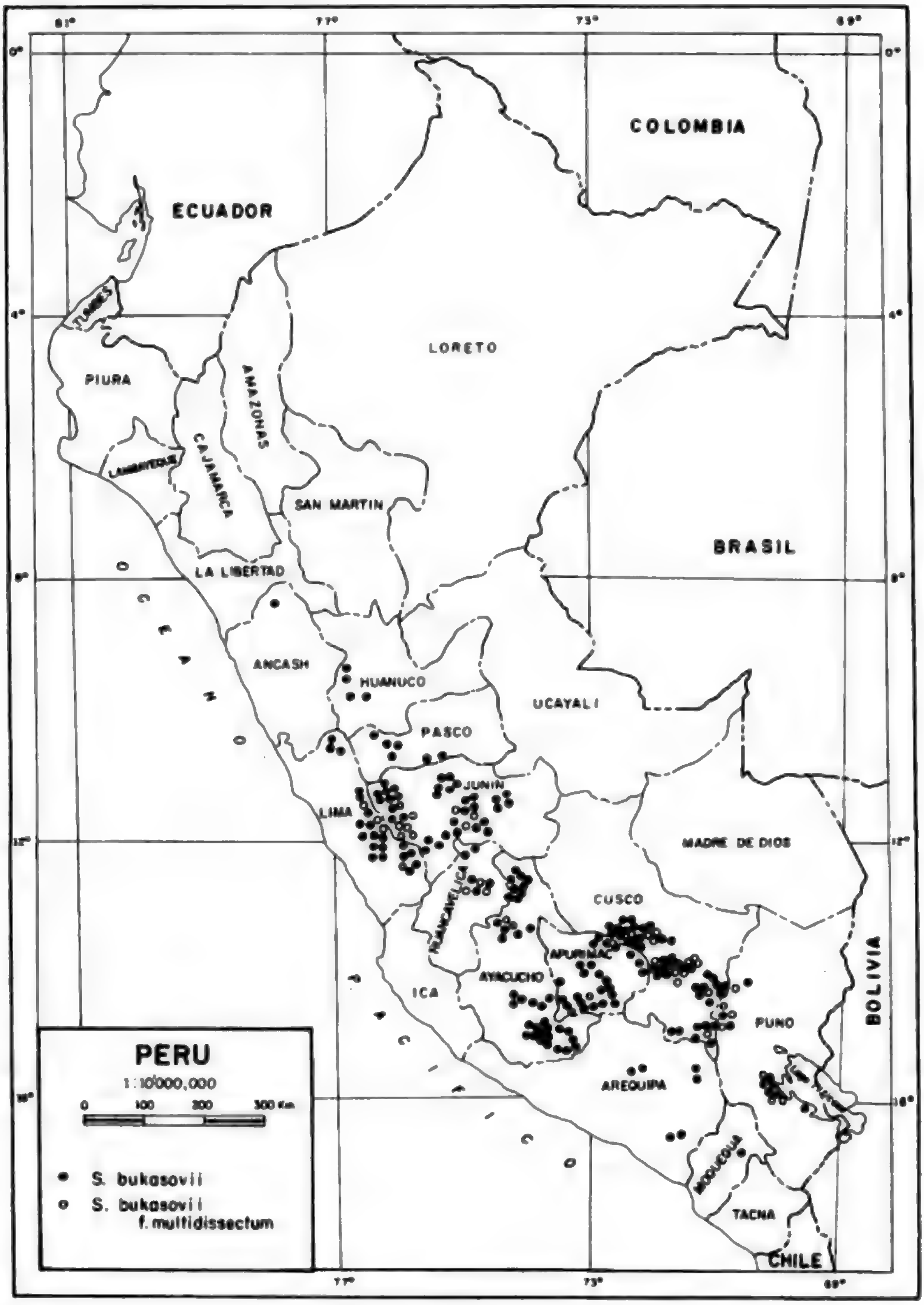


Figure 260. Paso de Ticlio, 4842 m alt., diverted waters of the Cordillera Occidental de los Andes between Lima and La Oroya. Photo: C. Ochoa, March 1985.

slope, 20-23 February 1960, *C Ochoa 2219* (OCH), *2219a* (OCH, from plants grown at Universidad Nacional Agraria La Molina, Lima) and *2219b,* (OCH, from plants grown at the Estación Exp. El Mantaro, near Jauja). Parguania, 2900 m alt., on talus slopes of the Cachora-Huanipaca railroad line, in a moist area wtih subshrubby vegetation, 20 February 1960, C. *Ochoa 2267*, 2n=24 (OCH, type collection of *S. abancayense)*. Near Ccorimarca, 2900-3200 m alt., along the Cachora-Huanipaca foot trail, in the foothills of a rocky mountain, 20 February 1960, *C. Ochoa 2270, 2271 and 2272* (OCH). Yanapajcha, 3500-3600 m, along the route Lambrama-Chuquibambilla, District Lucana, in the shade of old trees of *Eugenia oreophila* and *Polylepis* sp., 14 April 1962, *Ochoa 2423 and 2424* (OCH). Cima del Paso or Abra de Soccllack'asa, before the descent to Abancay, 4050 m alt., in an artificial roadside ditch, "leaf very similar to the type of *S. pumilum*, flowers large, blue-violet," 17 April 1971, *J. F. Hjerting, P.J. Cribb and Z. Huamán 5211* (CIP). A few km from Abancay, along the route Abancay-Cusco, 20 April 1975, *R. Ortega S-7* (OCH). Above and to the western side of the Cachora-Tambobamba railroad line in the Unilateralion of Huanipaca, 3250 m alt., in moist thickets among shrubs of *Mutisia, Eupatorium and Bacharis* with an understory of grasses and herbs, 21 April 1975, C. *Ochoa 7712* (OCH). Near Liwirco, 3800 m alt., following along the Huanipaca railroad route to the intersection of the Abancay-Cusco road, which is a region very foggy and moist, associated with shrubby plants and different herbs, 21 April 1975, *C. Ochoa 7715*, 2n=24 (CIP, F, NY, OCH). Highlands to the southwest of Cachora, eastern flanks of the grand mountain of Ampay, near Liwirco, 3750-4000 m alt., plants rosette-forming or without rosettes, small or well developed, according to the sites were they grow, berries ovoid, green marked with white dots and deep violet stripes, in open fields, in grasslands or in thickets, in a very foggy region, dominated by colonies with numerous plants, 21 April 1975, C. *Ochoa 7716* (OCH), *7717* (CIP, OCH), *7718, 7719* (OCH), *7720 (*CIP, OCH), 7721, 7722, 7724 (OCH), *7725* (OCH), and 7726 (CIP, OCH). Cunyari, 3750 m alt., on the upper slopes of Huaccana, n.v. *Atokk-papa* (= Fox Potato), near cultivated fields, May 1975, C. *Ochoa 9088* and *9089*, 2n=24 (CIP, MOL, OCH, from plants grown in the greenhouse at Huancayo). Slopes of Huayracalle, 3700 m alt., heading down from Chocke Quirao to Cachora, on the left bank of the Apurímac River, with *Stipa ichu*, 2 February 1980, *C. Ochoa 13598* and *13599*, 2n=24 (CIP, GH, MOL, NY, OCH, US). Near km 35, following by the Abancay-Cusco road, 3800 m alt., among *Stipa, Urtica* and *Cajophora*, 2 February 1980, *C. Ochoa 13600*, 2n=24 (CIP, GH, MOL, NY, OCH, US). At km 39 of the Abancay-Cusco road, 4000 m alt., plants small with medium purple-violet flowers, among *Stipa, Urtica* and *Cajophora*, 2 February 1980, *C. Ochoa 13601* (OCH). Chuñunapampa, 3800 m alt., in *puna* grassland, entering by detour of the Abancay-Cusco trunk road to the highlands of Saywite up to Cachora, among small shrubs of *Cassia* and tufts of *Stipa*, 2 February 1980, *C. Ochoa 13602*, 2n=24 (CIP, GH, MOL, OCH, US). Lower levels of mountains in the vicinity of Saywite, 3750 m, between Abancay and Cusco, corolla deep violet, 2.8-3.0 cm in dia., 23 March 1980, C. *Ochoa 13803* (OCH). Near Chuñunapampa, above and about 8 km to the west-southwest of Cachora, along the railroad route to Liwirco, 3800 m alt., in *puna*, moist slopes with *Berberis sp.* and small shrubs of *Cassia sp.*, 17 March 1981, C. *Ochoa 14332*, 2n=24 (CIP, OCH). Along the railroad line between Chuñunapampa and Liwirco, 3750 m alt., *puna*, with *Stipa, Astragalus, Calceolaria, Cuphea, Cajophora, Ranunculus, Bidens, Alternanthera*, 17 March 1981, *C. Ochoa 14333* (CIP, MOL, NY, OCH, US). Lower slopes of Cerro Inca Ccacca, 3700 m alt., near Liwirco, in forests of *Buddleja, Eupatorium, Barnadesia, Senecio, Bidens, Calceolaria, Astragalus, Salvia, Lupinus*, flowers blue-violet, large, up to 5 cm in dia., 17 March 1981, C. *Ochoa 14334*, 2n=24 (CIP, GH, MOL, NY, OCH, US). Near km 36 of the Abancay-Cusco road, 3800 m alt., in *puna* with *Stipa ichu*, plant very pubescent, corolla deep bluish-violet, 3 cm in dia., tubers oval-flattened to ovoid, 2-3 cm long, light brown, 30 March 1981, C. *Ochoa 14382*, 2n=24 (OCH). Lower levels of Cerro Quisapata, 3200 m alt., 1/2 km to the west of Abancay, 30 March 1981, *C. Ochoa 14383*, 2n=24 (CIP, MOL, NY, OCH). At km 37 of the Abancay-Cusco road, in the area of Succllaccasa, 3950 m alt., *L.E. López 1582* (CIP, OCH).

Province Andahuaylas: Cavira, 4000 m alt., on a sandy hillside, flower purple, 3 January 1950, *C. Vargas C. 8673* (LL, CUZ). Andahuaylas, along the edges of a small farm, plants herbaceous and tuber-bearing, 4 January 1950, *C. Vargas C. 8690* (CUS, LL). Chincheros, 2300 m alt. (2900 m alt.), 26 April 1959, *C. Vargas C. 12813* (CUZ, OCH). At km 79 of the route Abancay-Andahuaylas, 3900 m alt., 18 April 1971, *J.P. Hjerting, P.J. Cribb and Z. Huamán 5220* (CIP), *5221*, collected in the same place and date but leaflets broader and leaves less divided than No. *5220*, flowers blue-violet (CIP), and *5222*, collected in the same place as No. *5220*, plants 50 cm tall, among trees near fields of potatoes (CIP). Talus slopes along the Abancay-Andahuaylas road, at km 82-83, 3900 m alt., flower large and blue-violet, fruit long, mottled, up to 3.5 cm in dia., 18 April 1971, *J.G. Hawkes, J.P. Hjerting, P.J. Cribb and Z. Huamán 5225* (CIP). 108.5 km from Abancay. 3500 m, fruits to 2.0 cm diam., April 18, 1971, *J.G. Hawkes and P.J. Cribb 5226* (CIP). Grasslands of Huantana, 3800 m alt., in *punas* near San Jerónimo-Andahuaylas, 24 April 1975, *C. Ochoa* 7736 (OCH). Pisacalla, 3820 m alt., near Pampachiri, n.v. *Atokk-papa*, May 1975, C. *Ochoa 9795*, 2n=24 (CIP, F, GH, MOL, OCH, US, from plants grown at Huancayo or Sturgeon Bay, Wis., U.S.A.). Pumapata, 3700 m alt., between Andahuaylas and Pampachiri, May 1975, *C. Ochoa and A. Salas 9800* (OCH), *9802*, 2n=24, (CIP, NY, OCH, US, from plants grown at CIP-Huancayo), and *9803*, 2n=24 (CIP,



Map 22. Distribution of *S. bukasovii* and *S. bukasovii* f. *multidissectum*.

OCH). Alalaylla, 4200, between Andahuaylas and Pampachiri, May 1975, C. *Ochoa and A. Salas 9816* (CIP, OCH). Cunetaj Ck'uchu, 3850 m alt., above Kkenhuaranra, between Andahuaylas and Pampachiri, May 1975, *C. Ochoa and A. Salas 9830* (CIP, OCH). At km 79 (Kishuara), 3750 m alt., highway Abancay-Andahuaylas, without date, *L.E. López 1505* (CIP, OCH). Ruins of Sondor, high part of the fortress, 3260 m alt., District of Pacucha, without date, *L.E. López 1554* (CIP). At km 89 of the Abancay-Andahuaylas road, 3785 m alt., without date, *L.E. López 1613* (CIP, OCH). At km 79 of the Abancay-Andahuaylas road, without date, *L.E. López 1615* and *1615/2* (CIP, OCH). At km 71, in the area of gorge Cruz Ccasa on the route Abancay-Andahuaylas, without date, *L.E. López 1616* (CIP).

Province Antabamba: Cerro Ellahuachacc, 3600 m alt., facing Antabamba, 8-9 February 1960, C. *Ochoa 2253* and *2254* (OCH). Quebrada of Ckella, 3420 m alt., near Matara, 25 March 1972, C. *Ochoa 3287* (OCH). Ckeshua, 3550 m alt., near Matara, plants small, 7-10 cm tall, 25 March 1972, C. *Ochoa 3288* (OCH). Apacheta Punta, 3550 m alt., near Matara, plants with delicate appearance, 10 cm tall, little dissected leaves, corolla large, blue-violet, 25 March 1972, C. *Ochoa 3289* (OCH). Maras, 3650 m alt., near Antabamba, plants with delicate appearance, corolla large, 3.5 cm in dia., 25 March 1972, C. *Ochoa 3291* (OCH). Huaylla-huaylla, 3500 m alt., near Vito, dist. Antabamba, 25 March 1972, C. *Ochoa 3292* (OCH). Tormanya, 3300 m alt., near Mollebamba, dist. Antabamba , plants with delicate appearance, small, 15-20 cm tall, corolla large, rotate-pentagonal, 25 March 1972, C. *Ochoa 3294* (OCH). Between Mollebamba and Calcauso, 3250 m alt., near hot baths of Lapajca, 22 February 1980, C. *Ochoa 13663*, 2n=24 (CIP, OCH, from plants propagated in the fields at Huancayo and in the greenhouse at Huancayo from the original tubers). Apacheta, 4280 m alt., high pass between Mollebamba and Antabamba, among large rocks protected by *Cajophora* and small plants of *Bacharis*, 22 February 1980, C. *Ochoa 13666*, 2n=24 (CIP, OCH). Tomarencca, 3450 m, heading down from Antabamba, pedicels articulated 10-12 mm below the calyx, 21-23 February 1980, C. *Ochoa 13668*, 2n=24 (CIP, OCH). Media Luna, 3550 m, trails of Antabamba, 22 February 1980, C. *Ochoa 13669* (OCH). Near Tunabamba, 3500 m alt., along the trail between Antabamba and Huaquirca, flowers large, blue-violet, 23 February 1980, C. *Ochoa 13670*, 2n=24 (OCH). Pampa Pampa, 3550 m alt., near Antabamba, along the rocky upper trails, 23 February 1980, C. *Ochoa 13672*, 2n=24 (CIP, OCH, MOL, UNTC, from plants grown from tubers in the greenhouse at Huancayo) and (OCH, from a plant propagated from tubers in the field at Huancayo).

Province Aymaraes: Between Chalhuanca and Cotaruse, 3350 m alt., in dry and rocky soil, berries ovoid, green marked vertically with deep violet stripes, 20 March 1980, *Ochoa 13811*, 2n=24 (CIP, OCH, US, USM). Near Siete Vueltas, 3600 m alt., above Cotaruse, going from Cotaruse to Pampa Negro Mayo, along the route to Puquio, 26 March 1980, *C. Ochoa 13813*, 2n=24 (CIP, OCH, USM), *13814 and 13814A* (CIP, OCH, from plants grown in the greenhouse at Huancayo). Siete Vueltas, 3900 m alt., along the route Chalhuanca-Puquio, leaves well dissected, flowers small, berries ovoid, 30 March 1981, *C. Ochoa 14388*, 2n=24 (CIP, MOL, OCH, US, from plants grown at Huancayo).

Province Cotabambas: Highlands of Cotabambas, 3750 m alt., on hillsides and occasional thickets, corolla blue, 4 March 1946, *C. Vargas C. 5780* (CUZ, LL, OCH). Near Ayahuayc'ko, 3700 m alt., between Tambobamba and Huallhuac, 29 February 1980, *C. Ochoa 13676*, 2n=24 (CIP, OCH). Pampas de Ticapallana, 4200 m alt., between Cotabambas and Tambobamba, in *puna* grasslands between large tufts of *Stipa ichu*, leaflets elliptic to obovate-elliptic, the apex obtuse or pointed, 1 March 1980, *C. Ochoa 13678*, 2n=24, *13679*, 2n=24 (CIP, MOL, F, GH, NY, OCH, US), *13680*, 2n=24 (CIP, OCH, US), and *13681*, 2n=24 (CIP, MOL, NY, OCH, US). Llulluchayocc, 4200 m alt., a little before Cotabambas, along the route Tambobamba-Cotabambas, plants vigorous, very pilose, flowers blue or blue-violet, 1 March 1980, *C. Ochoa 13682*, 2n=24 (CIP, GH, MOL, NY, OCH, US). Aquillani, 4100 m alt., in *puna* grasslands between Tambobamba and Cotabambas, flowers large blue-violet, 1 March 1980, *C. Ochoa 13684*, 2n=24 (F, OCH).

Province Grau: Vicinity of Ayrihuanca, 3200 m alt., along the route Ayrihuanca-Pamparaccay, 20 February 1960, *C. Ochoa 2224* (OCH). Miscua, 3200 m alt., between Ayrihuanca and Pamparaccay, 20 February 1960, *C. Ochoa 2225* (OCH). Pamparaccay, 3300 m alt., 20 February 1960, *C. Ochoa 2227* (OCH), *2230* (OCH) and *2230A* (OCH, US, from plants grown at Universidad Nacional Agraria La Molina, Lima). Puysho, 3000 m alt., about 5 km from Ayrihuanca along the route Vilcabamba-Ayrihuanca, 20 February 1960, *C. Ochoa 2242* (OCH). Near Chuquibambilla, 3000 m alt., along the route Lambrama-Chuquibambilla, April 1962, *C. Ochoa 2435* (OCH, plants grown from seed at the Universidad Nacional Agraria La Molina, Lima). Near Alccochimpa, 3000 m alt., between Chuquibambilla and Vilcabamba, along the route Chuquibambilla-Ayrihuanca, April 1962, *C. Ochoa 2436* (OCH, plants grown from tubers at the Universidad Nacional Agraria La Molina, Lima). Between Lambrama and Chuquibambilla, 3650 m alt., April 1972, *C Ochoa 3660* (OCH, from plants grown at Universidad Nacional Agraria La Molina, Lima). Vicinity of

Chuquibambilla, 3350 m alt., entering by the route Lambrama-Chuquibambilla, April 1972, *C. Ochoa 3661* (OCH, plants grown from seed at the Universidad Nacional Agraria La Molina, Lima, in December 1973). Near Pamparaccay, 3400 m alt., along the route Vilcabamba-Mamara, April 1972, *C. Ochoa 3662* (OCH, plants grown from seed at the Universidad Nacional Agraria La Molina, Lima). Rajrama, 3680 m alt., between San Antonio and Ayrihuanca, in *puna* grassland and among small trees of *Buddleja*; corolla blue-violet, 8 March 1980, *C. Ochoa 13742*, 2n=24 (CIP, OCH, from plants grown at Huancayo). Pajcharec, ca. 4000 m alt., along the route San Antonio-Ayrihuanca, in grasslands of *Stipa ichu*, berries round, 9 March 1980, *C. Ochoa 13746*, 2n=24 (OCH) and (CIP, from plants propagated in the greenhouse at Huancayo). Pakkarek, ca. 4200 m alt., along the route San Antonio-Ayrihuanca, in *puna* grasslands, 9 March 1980, 2n=24, *C. Ochoa 13747*, 2n=24 (OCH, from plants grown in the greenhouse at Huancayo). Pucapata, 3200 m alt., heading up the road from Vilcabamba-Ayrihuanca, 20 March 1980, *C. Ochoa 13749B*, 2n=24 (CIP, OCH, from plants grown in the greenhouse at Huancayo). Between Chuquibambilla and Vilcabamba, 3100 m alt. 20 February 1960, *C. Ochoa S-12* (= *PI-365320*), 2n=24 (US, plants grown from seed at Sturgeon Bay, Wis., U.S.A., IR-1 Project).

Department Arequipa

Province Arequipa: Near Arequipa, 2000-2500 m. February 14-26, 1923; *Guenther and Buchtien 1402, 1405, 1409, and 1414* (HBG). Baños de Jesús, east of Arequipa, 1 km from Baños de Jesús toward Puno, 2500 m (16° 24' S, 71° 30' W). Sandy soil (volcanic ash) in open places With small shrubs, near road, small populations scattered here and there, small plants in flower, mother tubers but no berries, flowers bright violet-purple [Plant 0.35 m high, semi-rosette habit], March 4, 1974, *J.G. Hawkes, A. M. van Harten and J. Landeo 5407* (CIP).

Province Cailloma: Vicinity of Pulpera along the route Chivay-Shibayo, 4000 m alt., in *puna* grassland, on overhangs or rocky slopes, corolla light blue-violet, 3 cm dia., leaves little divided, 29 March 1974, *C. Ochoa 5106*, 2n=24 (OCH, from the original plants) and *5106* (CIP, OCH, from plants grown in the greenhouse at Huancayo). Anajpampa, 3660 m alt., between Shibayo and Tute, on rocky hillsides and among large rocks, flowers purple-violet, growing with *S. acaule, Stipa, Lupinus, Rumex, Bidens*, 6 March 1981, *C. Ochoa 14275*, 2n=24 (CIP, OCH, US).

Province Condesuyos: Above Bodegayoc, 3550-3650 m alt., along the route Chuquibamba-Cotahuasi, 31 March 1974, *C. Ochoa 5117* (CIP, MOL, OCH) and *5118* (OCH).

Department Ayacucho

Province Cangallo: Pallcca, 3200 m alt., between the Pampas River and Ayacucho, May 24, 1939, *E.K. Balls and J.G. Hawkes 6931* (type collections of *S. fragariaefructum* from plants grown in the field, Cambridge, England). 36 km on road from Ayacucho towards Andahuaylas, 3900 m alt. April 17, 1953; *Peterson and Hjerting 1407* (US, from plants grown at Sturgeon Bay, Wis., USA, Summer 1987). Above Ocros, 3800 m, 73 km from Chincheros on Ayacucho road. April 18, 1971, *J.G. Hawkes, J.P. Hjerting, P.J. Cribb, and Z. Huamán 5233* (CIP). Caballo Machay, 3400 m alt., between Condorchaca and Vischongo, May 1975, *C. Ochoa and A. Salas 10114*, 2n=24 (CIP, MOL, OCH, from plants grown in the greenhouse at Huancayo from the original tubers) and *10115* , 2n=24 (CIP, OCH).

Province Huamanga: Heading down from Ccollaccasa Pass toward Ocros, 3800 m alt., 8 February 1958, *C. Ochoa 2146* (OCH). Pacurí, 3300 m alt., near Ayacucho along the route Socos-Vinchos, growing with *S. bukasovii* f. *multidissectum*, 9 February 1958, C. *Ochoa 2147* (OCH). Lower levels of Condorcunca, 3200 m alt., heading up the road from La Quinua toward Tambo, in shrubby moist thickets, 10 February 1958, *C. Ochoa 2148* (OCH). Palca, 3400 m alt., heading up the La Quinua highway toward Tambo, 10 February 1958, *C. Ochoa 2149* (OCH). 20 km from Ayacucho on way to Chiara, growing with *Cassia, Calceolaria, Bidens, Baccharis, Lupinus*, etc., 2900 m alt., April 26, 1959, *Perez, R. Rimpau, H. Ross and C. Vargas 978* (MAX). Between Huamanguilla and Huayopampa, 3000 m alt., 20 March 1966, C. *Ochoa S-65* (= *PI-365367*), 2n=24 (CIP, OCH, US, from plants grown at Sturgeon Bay, Wis., U.S.A.). Heading down from Tocto toward Ayacucho, 3000 m alt., between milestone Tocto and Ayacucho, 16 March 1967, *C. Ochoa 2624* (OCH). In the quebrada between Ayacucho and Pampa de Chupas, near stream, associated with *Alonsoa, Rumex, Lupinus, Bacharis* in the shade of trees of *Escallonia*, 10 February 1968, *J. Soukup 5551* (OCH). Tarapata, 2950 m alt., near Ayacucho, between stone piles protected by *Opuntia exaltata, Opuntia tuna*, among shrubs of *Lantana* and trees of *Schinus molle*, n.v. *Ck'ita Papa* (= Papa Silvestre), flowers deep purple, January 1975, *C. Ochoa 7257* (CIP, OCH, US). Alpachaca, 3800 m alt., April 1976, *C. Ochoa 11058*, 2n=24 (CIP, F, MOL, NY, OCH, US, from plants grown from seed at Huancayo). Lower slopes of Cerro Condorcunca, 3600 m alt., near La Quinua, February 1979, *C. Ochoa 13194*, 2n=24 (CIP, OCH), and *13195*, 2n=24 (CIP, MOL, OCH). Pallca, 3850-3900 m alt., between kms 33-34 of the route Quinua-Tambo, near a stream, with spiny shrubs of Ttancar (= *Solanum lycioides*) and large tufts of *Stipa ichu*, 25-28 April 1982, C. *Ochoa 14735*, 2n=24 (CIP, OCH), and *14736* (CIP). Between kms 27-28 of the route La Quinua-Tambo, 3600 m alt., among shrubby vegetation principally of *Cassia* sp. and

Solanum lycioides with an understory of grasses, 25-28 April 1982, *C. Ochoa 14737* (CIP, OCH), *14738* (OCH), and *14739* (CIP, MOL, OCH). Quinua Huayck'o, 3400 m alt., between Huamanguilla and La Quinua, alongside the stream Quinua Huayck'o, among trees of *Alnus jorullensis* and *Escallonia* sp. and shrubby thickets of Cassia and *Dunalia lycioides*, 25-28 April 1982, *C. Ochoa 14740* (CIP, OCH). Between Ayacucho and La Quinua, 4060 m alt., without date, *L.E. López 1866 and 1867* (CIP).

Province Huanta: C'kulluchaca, 3000 m alt., about 5 km to the east of Huanta, 13 March 1967, *C. Ochoa 2616* (OCH). Heading up from Huanta to C'kulluchaca by the road to Uchuraccay, 3500-3750 m alt., 13 March 1967, *C. Ochoa 2617* and *2618*, (OCH). Highlands of C'kulluchaca, 3800 m alt., along the route Huanta-Uchuraccay, to the east of Huanta, 13 March 1967, *C. Ochoa 2619* (OCH). Pajchapata, 3900 m alt., above Ck'ulluchaca, to the east of Huanta along the Huanta-Uchuraccay railroad line, 13 March 1967, *C. Ochoa 2620* (OCH, US). Huatuscalla, 3000 m alt., District of Laricocha, heading up the Huanta-Uchuraccay rail line, 4 January-10 February 1975, *C. Ochoa 7342*, (CIP, OCH), and *7343* (CIP, F, NY, OCH, US).

Province La Mar: Between Tincocc and Cascajal, 3850-3950 m alt., near Tapuna, from Huanta towards the rainforest, April 1972, *C. Ochoa 3295, 3296, 3297* and *3298* (OCH). Quebrada de Huito, 3650 m alt., between La Quinua and Tambo along the route Ayacucho-San Miguel, 4 January-10 February 1975, *C. Ochoa 7265* (OCH, US). Highlands of Yanta Yanta, 3550 m alt., in *puna* grassland, to the east of San Miguel, along the route San Miguel-Yanta Yanta, 12-30 February 1979, *C. Ochoa and A. Salas 13190* (CIP, OCH, US). Usmay, 3600 m alt., between Tinco and the Usmay Ck'asa Pass, along the Tambo-Yanta Yanta railroad line, 12-30 February 1979, *C. Ochoa and A. Salas 13191*, 2n=24 (CIP, GH, MOL, OCH, US). Km 417, second mile-stone between La Quinua and Tambo, April 1980, *S. Keel s.n.* (OCH, from a plant grown from tubers at La Molina, Lima). Quillacancha, 3850 m alt., *punas* above Tambo, in pastures and shrubby thickets, corolla large, deep violet, 25-28 April 1982, *C. Ochoa 14733* and *14734* (CIP, OCH). At km 24, between La Quinua and Tambo, in the area of Tantar, 3700 m alt., without date, *L.E. López 1797* (CIP, OCH), *1800* (CIP), *1801* (CIP, OCH) and *1802* (CIP).

Province Lucanas: Heading down the highway from Puquio to Nazca, 3600-3700 m alt., 20 March 1949, *R. Ferreyra 5502* (USM). Above Puquio, 3400-3500 m alt., between Nazca and Puquio, on a stony mountain, flowers purple, 20 March 1949, *R. Ferreyra 5515* (LL, USM). In grassy sandy meadow along stream, 90 km from Nazca on road to Puquio, 3900 m, plant small, leaves purplish on both surfaces, small tubers,14 February 1958, *D.S. Correll and E.E. Smith P153* (LL). In shelter of boulders along stream, 126 km from Nazca on road to Puquio, 4100 m, plants small, flowers purplish, 14 February 1958, *D.S. Correll and E.E. Smith P157* (LL). Among boulders and shrubs in grassland, 35 km from Puquio on road to Nazca-Ayacucho, 3500 m, plant small, flowers pale lavender blue, 15 February 1958, *D.S. Correll and E.E. Smith P162* (LL). In field of cultivated potatoes, 13 km from Puquio on road to Nazca, 3800 m alt., flowers purplish blue, 15 February 1958, *D.S. Correll and E.E. Smith P168* (LL). Yana Ccacca, 3700 m alt., near Puquio along the highway route Puquio-Nazca, 15 February 1958, *C. Ochoa 2152*, 2n=24 (OCH). About 15 km before Puquio, 3500 m alt., along the route Nazca-Puquio, 20 February 20 1960, C. *Ochoa 2245* (OCH). Ogorón Pampa, 3500 m alt., *punas* between Puquio and Andamarca, 15-20 March 1972 *C. Ochoa 3267* (OCH). Pali, 3200 m alt., near and to the east of Puquio on talus slopes along the Puquio-Chalhuanca road, 15-20 March 1972, *C. Ochoa 3270* and *3273* (OCH). Dartachayoc, 4000 m alt., in *puna* grassland, near the Yaurihuiri lagoon, margins of the Puquio-Chalhuanca road, May 1975, *C. Ochoa 10005* (OCH). Negro Mayo, 4000 m alt., with *Stipa and Cajophora*, in rocky soil, 26 March 1980, C. *Ochoa 13815*, 2n=24 (CIP, OCH). Between Puquio and Lucanas, 3200 m alt., corolla blue-violet, 26 March 1980, C. *Ochoa 13822*, 2n=24 (CIP, OCH, plants grown from tubers at Huancayo). Heading up to Pampa Galeras, via Lucanas, 3800 m alt., growing with *Solanum acaule*, 26 March 1980, *C. Ochoa 13829*, 2n=24 (CIP, OCH, plants grown from tubers at Huancayo) and *13830*, 2n=24 (CIP, F. MOL, NY, OCH, US, plants grown from tubers at Huancayo). Facing Pomantaca, 3800 m alt., Pampa Galeras, along the route to Lucanas, 9 April 1980, *C. Ochoa 13832*, 2n=24 (CIP, OCH). Near Puquio, 3400 m alt., 30 March 1981, *C. Ochoa 14399*, 2n=24 (CIP, OCH). Between Lucanas and Puquio, 3250 m alt., 30 March 1981, *C. Ochoa 14400*, 2n=24 (CIP, OCH, US). Near Lucanas, 3350 m alt., corolla violet, 30 March 1981, *C. Ochoa 14401*, 2n=24 (OCH) and (CIP, US, from plants grown from seed at Huancayo). Near km 72 of the road Puquio-Nazca, 3700 m alt., 30 March 1981, C. *Ochoa 14404*, 2n=24 (CIP, OCH).

Province Parinacochas: Cuncalla, 3600 m alt., about 2 km northeast of Coracora, 15-20 April 1971, *C. Ochoa* and *A. Salas 2991* (CIP, OCH, US). Huishca, 3300 m alt., near Coracora, 15-20 April 1971, *C. Ochoa 2992 and 3048* (OCH, from plants grown from seed at the Universidad Nacional Agraria La Molina, Lima). Between Trapiche and Cuncalla, 3600 m alt., near Coracora, along the route to Ccolli, 15-20 April 1971, *C. Ochoa 2993* (OCH). Chintaccata, 3300 m alt., between Coracora and Chumpi, 15-20 April 1971, *C. Ochoa 2995* (OCH). Santa Bárbara, 3220 m alt., to the east of Coracora, 15-20 April 1971, *C. Ochoa 2996* (OCH). Puca Gallo, 3600 m alt., on the lower levels of Cerro Turpuylla, between Coracora and Chumpi, 15-20 April 1971, *C. Ochoa 2997* (OCH). Near right bank of the Chilcahuayco River and the lower slopes of Ckeccacha Orcco, 3600 m alt., 15-20 April 1971, *C. Ochoa 2998* (OCH). San Felipe, 3200 m alt., near Coracora, 15-20 April 1971, *C. Ochoa 2999* and *3049* (OCH, plants grown at Universidad Nacional Agraria from original seed). Pampas de Oyolo, 3450-3550 m alt., 15-20 April 1971, *C. Ochoa 3005* (OCH). Bellavista, 3400 m alt., between Coracora and Anoccacca, 15-20 April 1971, *C. Ochoa 3006* (OCH). Between Incuyo and Lampa, 3600 m alt., 15-20 April 1971, *C. Ochoa 3007* (OCH). Between Lampa and Oyolo, 3600 m alt., 15-20 April 1971, *C. Ochoa 3009* (OCH). Colloni, 3600 m alt., near Incuyo, 15-20 April 1971, *C. Ochoa 3050* (OCH, from plants grown at Universidad Nacional Agraria La Molina, Lima). Lower levels of Cerro Anoccacca, 3400-3500 m alt., District of Chumpi, 15 March 1972, *C. Ochoa 3254* and *3255* (OCH). Millu Huayck'o, 3200 m alt., between Chumpi and the Tastamayo River, 15 March 1972, *C. Ochoa and A. Salas 3256* (CIP, F, OCH, US). Near banks of the Tastamayo River, 3200 m alt., following the route from Coracora to Chumpi, 15 March 1972, *C. Ochoa 3260* (OCH). Lamopampa, 3800 m alt., between Colta and Oyolo, 22 April 1975, *C. Ochoa and A. Salas 9867* (OCH). Lamopampa, 3800 m alt., between Colta and Oyolo, District Colta, April-May 1975, *C. Ochoa and A. Salas 9878*, 2n=24 (CIP, OCH, plants grown from tubers at Huancayo). Intihuatana, 3600 m alt., between Carhuanilla and Incahuasi, District Chumpi, April-May 1975, *C. Ochoa and A. Salas 9879* (OCH). Chuasuro, 3100 m alt., District of Colta, 19 April-12 May 1975, *C. Ochoa and A. Salas 9928*, 2n=24 (CIP, OCH), (CIP, OCH, from plants propagated in the fields at Huancayo and La Molina, Lima) and (CIP, OCH, from plants propagated in the greenhouse at Huancayo. Cerro Anoccacca, 3500 m alt., about 10 km east of Chumpi, August 1978, *C. Ochoa and A. Salas 13032* (CIP, MOL, OCH, plants grown from tubers at La Molina, Lima). Chillca Huayck'o, 3400 m alt., near Cuncalla, in the District Coracora, March 1984, *C. Ochoa 15368* (OCH). Pucapampa, 3700 m alt., west of Pacapausa, March 1984, *C. Ochoa 15374* (OCH). Near Rivacayco, 3200 m alt., between Alpabamba and Pacapausa, near Huanca River, March 1984, *C. Ochoa 15375* (OCH). Between Pacapausa and Patari, 3600 m alt., about 5 km southeast of Pacapausa, March 1984, *C. Ochoa 15376* (OCH). Near Pacapausa, 3000 m alt., March 1984, *C. Ochoa 15377* (OCH).

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Province Acomayo: Cerro Wilcacalle, 3760-4200 m alt., near Pomacanchi, amid *Stipa ichu, Chuquiraga, Cassia,* in the vicinity of cultivated fields of potato, barley and tarwi (= *Lupinus mutabilis), March*-April 1981, *R. Ortega 001, 002, 003, 004, 006, 007, 008 and 009* (OCH, from plants grown in 1982 at the Experimental Station at K'ayra, Cusco). Cerro Cruspata, 4100 m alt., near Pomacanchi, March-April 1981, *R. Ortega 010* (OCH, from plants grown at

K'ayra, Cusco in 1982). Cerro Ccasapata, 4050 m alt., near Pomacanchi, n.v. *Alkko Papa,* March-April 1981, *R. Ortega 015 and 016* (OCH, from plants grown at K'ayra, Cusco, in 1982). Ckeru Huayck'o or Ckeru Mocco, 3700 m alt., near Pomacanchi, March-April 1981, *R. Ortega 018* and *019* (OCH, from plants grown at K'ayra, Cusco, in 1982). Corccollo Mocco, 3800 m alt., near Mancura, District Pomacanchi, March-April 1981, *R. Ortega 022* (OCH, from plants grown at K'ayra, Cusco in 1982). Canchan Uran, 4000 m alt., District of Pomacanchi, March-April 1981, *R. Ortega 024* (OCH, from plants grown at K'ayra, Cusco in 1982). Cerro Apachita, 4200 m alt., District Pomacanchi, March-April 1981, *R. Ortega 029* (OCH, from plants grown at K'ayra, Cusco in 1982). Cerro Jacohuachana, 4100 m alt., *puna,* District of Pomacanchi, February 1982, *R. Ortega 030, 031, 033, 037, 038, 040* and *045* (OCH). Conchacalla, 3700 m alt., District Pomacanchi, February 1982, *R. Ortega 051, 053, 054, 055, 059, 061, 062, 064, 067, 068, 069, 070* and *073* (OCH). Wilcacalle, 4200 m alt., District Pomacanchi, associated with Chinchercoma (=*Mutisia*), Orcco-quisa (=*Urtica*), Llaulli (=*Chuquiraga*), cactus, *Stipa ichu* and other pasture grasses, growing in the vicinity of cultivated fields of potato, oca, tarwi and barley, February 1982, *R. Ortega 075, 076* and *077* (OCH). Between Pomacanchi and Conchacalla, 4200 m alt., in the vicinity of cultivated fields of potato, olluco and others, February1982, *R. Ortega 078, 079* and *080* (OCH). Along the route Pomacanchi-Toccorani, amid *Stipa ichu*, District Pomacanchi, February 1982, *R. Ortega 081, 086, 087 and 088* (OCH). Cerro Huahuayqui Orcco, along the route Pomacanchi-Toccorani, in straw (=*Stipa*) *and* quisa (=*Urtica*), near cultivated fields of potato, February 1982, *R. Ortega 082, 083, 084* and *085* (OCH). Near road Pomacanchi-San Juan de Conchacalla, in the vicinity of cultivated fields of potato, n.v. *Apharu Papa* (=Wild Potato), February 1982, *R. Ortega 092* (OCH). Luruchayoc, 3650 m alt., near km 25.5, along the route Chuquicahuana-Acomayo, just before the road descent to Acomayo, 15-18 March 1984, *C. Ochoa, Oscar and Mayhua Blanco 15689* (CIP, OCH), *15692*, 2n=24, (CIP, GH, MOL, OCH), *15693*, 2n=24 (CIP, OCH), and *15694* (CIP, MOL, OCH). Heading down from the Gorge of Acomayo toward Luruchayoc, 3400 m alt., among large rocks and within stone enclosures near shrubs of *Cassia and Chuquiraga*, 15 March 1984, *C. Ochoa, Oscar and Mayhua Blanco 15695*, 2n=24 (CIP, OCH). Cebadapata, 3500 m alt., near lagoon of Pomacanchi at the margins of cultivated fields of potato and maíz, 15 March 1984, *C. Ochoa, Oscar and Mayhua Blanco 15701* (CIP, OCH).

Province Anta: Totora, 3700 m alt., on or about enclosures and adobe walls, 10 March 1946, *C. Vargas C. 5875* (CUZ, LL). Heading down from la Pampa de Anta to Chinchajpujio, 3500 m alt., in rocky soil, 5 April 1966, *C. Vargas C. 017180* (CUZ, OCH). Near Jatunwaylla Pass, 3900 m alt., along the route Anta-Cotabambas, 2 March 1980, *C. Ochoa 13691*, 2n=24 (CIP, GH, MOL, NY, OCH, US) and *13692*, 2n=24 (OCH). Tojra, 3700 m alt., between Jatunwaylla and the Gorge of Anta, along the highway route Anta-Cotabambas, 2 March 1980, *C. Ochoa 13694*, 2n=24 (OCH) and *13694* (CIP, OCH, US, from plants grown at Huancayo). Churu Ck'asa, 3730 m alt., in *puna* grasslands, along the highway route Anta-Cotabambas, with *Bidens, Gnaphallum, Poa, Senecio, Astragalus* and small shrubs of *Barnadesia* and *Eupatorium, n.v. Atokk-papa,* abundant, this population of plants varies in the division of the leaves, size of the corolla and the round to ovoid shapes of its berries, 11 March 1980, *C. Ochoa 13711*, 2n=24 (CIP, GH, NY, MOL, OCH, US), *13712*, 2n=24 (CIP, GH, MOL, OCH, US), and *13712A*, 2n=24 (CIP, OCH, US). C'kumu Ccacca, 3650 m alt., 2 km from Ucra, heading down towards Chinchaypujio, abundant, within shrub enclosures of *Barnadesia*, corolla violet, large, 4.0-4.5 cm in dia., 11 March 1980, *C. Ochoa 13713*, 2n=24 (CIP, MOL, NY, OCH). Ucra and C'kumu Ccacca, 3650 m alt., *puna* grassland, in a broad deep ditch among shrubs of *Barnadesia*, n.v. *Atokk-papa*, dominated by colonies with large, violet or purple flowers, 11 March 1980, *C. Ochoa 13714*, 2n=24 (CIP, F, GH, NY, MOL, OCH, US). C'kumu-Ccacca, 3650 m alt., heading down from Ucra toward Chinchaypujio, via the highway Anta-Chinchaypujio, 11 March 1980, *C. Ochoa 13715*, 2n=24 (OCH). Ancahuasi, 3800 m alt., heading up from Limatambo toward the Pampa de Anta, along the route Limatambo-Cusco, corolla large, purple, 23 March 1980, *C. Ochoa 13796*, 2n=24, *13797*, 2n=24 (CIP, GH, MOL, NY, OCH, US). Wilkipata, 3800 m alt, 2 km from Incahuasi along the route Anta-Limatambo, corolla 3 cm in dia., purple, 23 March 1980, *C. Ochoa 13798*, 2n=24 (CIP, NY, GH, OCH, US), *13799*, 2n=24 (CIP, OCH, US), and *13800*, 2n=24 (CIP, MOL, NY, OCH, US).

Province Calca: Quebrada de Ccochocc, Calca, 2900-3000 m alt., on rocky hillsides alongside the road, plants 50 cm tall, 21-24 February 1944, *C. Vargas C. 4074* (CUZ). Intihuatana, 3400 m alt., Pissac, among stones, plant 40-50 cm tall, corolla violet, fruit round, 20 March 1945, *C. Vargas C. 5065* (CUZ, LL, OCH). Intihuatana, 3300 m alt., Pisacc [above the terraces], in sandy-stony soils, February 1946, *F. Marín 418 p.p.* (F). 9 km from Pisacc, 3400 m alt., along the route to Cusco, 27 February 1958, *D.S. Correll, E.E. Smith and C. Vargas C. P225* sheet-2 (LL). Puma Mutt'u, 3400 m alt., heading up by the Qebrada de Ccochocc toward Totora, near Calca, growing near *S. bukasovii* f. *multidissectum*, 19 February 1960, *C. Ochoa 2196* (OCH). Ruins of Pisacc, 3300 m alt., among trees below the ruins above the terraces, 11 April 1971, *J.G. Hawkes, J.P. Hjerting, P.J. Cribb, and Z. Huamán 5112* (CIP) and *5112* (US, from plants grown at Sturgeon Bay, Wis., U.S.A.). Yana Salla, 3800 m alt., heading down from Abra de Chaiña, toward Ajchahuata, by the highway Calca-Amparaes, at base of an enormous rock, 12 May 1975, *Ochoa 7953*, 2n=24 (CIP, OCH, from plants grown at Huancayo). Hillsides above Tunas Mocco, 3259 m alt., between Calca and Urubamba, 7 March 1980, *C. Ochoa 13699* (OCH). Near Ck'osñiritti, 3700 m alt., on rocky hillsides, along the route Calca-Lares, plants small, 20-25 cm tall, rosette-forming, flowers blue-violet, up to 4 cm or more in dia., 9 March 1980, *C. Ochoa 13707*, 2n=24 (CIP, OCH), *13707A* (CIP, OCH, US), and *13707B* (CIP, OCH, US). Between Puma Mutt'u and Sondor, 3550 m alt., above Machacancha, heading up the road Pisac-Machacancha, on rocky talus slopes, 17 March 1980, *C. Ochoa 13773*, 2n=24 (CIP, F, OCH). Atokk-chaca, 3900 m alt., between Marcachea and Amparaes, crossing Chaiña Pass along the route Calca-Amparaes, in black moist soils on hillsides, between tufts of *Stipa ichu, Calceolaria, Rumex* and *Cajophora*, 21 March 1980, *C. Ochoa 13789* (CIP, OCH), *13791*, 2n=24 (CIP, F, OCH, US). Atokk-chaca, 3800 m alt., *puna*, between Marcachea and Amparaes, on hillsides covered with *Stipa ichu* 10 km from the Gorge of Chaiña, heading down towards Amparaes, 21 March 1980, *C. Ochoa 13790* (CIP, OCH), and *13792* (CIP, OCH). Near Totora, 3700 m alt., further down from Ckellu Pp'uytu, heading down from Ch'aiña Pass toward Calca, 22 March 1980, *C. Ochoa 13795*, 2n=24 (CIP, GH, F, MOL, OCH, US). Near Atokk-chaca, 3850 m alt., 9 km before Amparaes heading down from Chaiña Pass and Ajchahuata, along the route Calca-Amparaes, in *puna* grassland, berries ovoid large, green, with white dots and dark purple vertical stripes, March 1981, *C Ochoa 14309*, 2n=24 (CIP, F, GH, MOL, NY, OCH, US), *14310* (CIP, GH, MOL, NY, OCH, US), *14311*, 2n=24 (CIP, F, GH, MOL, NY, OCH, US), *14312*, 2n=24 (CIP, F, GH, MOL, NY, OCH, US) and *14313*, 2n=24 (CIP, MOL, OCH, US). Lower slopes of Huaccai Huillca, 4300 m alt., between Ppalchayocc and Huaccai Huillca, along the route Ck'osñiritti to the Panticalla Pass, in a rocky area associated with *S. acaule, Stipa ichu*, small trees of *Polylepis* and shrubs of *Barnadesia*, plants small with deep lilac corollas and of variable size, 2.8-3.5 cm in dia., 22 March 1981, *C. Ochoa 14355*, 2n=24 (CIP, F, GH, MOL, OCH, US). Punas de Tamboraccay, 3800 m alt., along the route Sacaca-Chahuaitiri, 20-30 March 1983, *C. Ochoa 15115*, 2n=24 (CIP, OCH, US, from plants grown in the greenhouse at Huancayo).

Province Canas: Asuncion Bridge, 3800 m alt., on Apurimac river, among rocks. February 28, 1939; *C. Vargas C.: 2001* (CPC, CUZ, K, type collection of *S. canasense,* plants grown from tubers in a field at Cambridge, England)*; 11032* (F, NA, UC) and *1542* (CUZ, the same as numbers *2001* and *11032B* according to Vargas). El Descanso, 4250 m alt., in grassland, 5 February 1951, *C. Vargas C. 10037* (CUZ, LL, topotypes of *S. acaule* var. *checcae).* Checca, 3800 m alt., among stone walls, near entrance to Checca, along the route Cusco-Checca, among plants of *Stipa ichu* and cultivars, 4-7 April 1978, *C. Ochoa and M. A. Pacheco 12039*, 2n=24 (CIP, OCH, US, topotype of *S. multidissectum* Hawkes*).* Checca, 3800 m alt., between tufts of *Stipa ichu*, very rare, 4-7 April 1978, *C. Ochoa and M. A. Pacheco 12039A* (OCH, topotype of *S. multidissectum* Hawkes). Near Asunción bridge, 3820 m alt., above the Apurímac River, plant vigorous, leaves leaflets narrowly elliptic-lanceolate, corolla large, April 1978, *C. Ochoa and M. A. Pacheco 12041*, 2n=24 (OCH, US, topotypes of *S. canasense* Hawkes). Near Patactira River, 3700 m alt., a few km from the detour to Checca, along the route Sicuani-Yauri, 15-18 March 1984, *C. Ochoa, Oscar and Mayhua Blanco 15676*, 2n=24 (CIP, OCH) and *15677* (CIP, OCH, US). Checca, 3800 m alt., within stone enclosures, protected by *Urtica* and *Cajophora*, growing with *Ullucus* silvestres, 15-18 March 1984, *C. Ochoa, Oscar and Mayhua Blanco 15681*, 2n=24 (CIP, OCH, topotypes of *S. multidissectum)* and *15683* (CIP, MOL, OCH, US). Chacarckata [ca. 3650 m alt.], along the route Sicuani-Yauri, near Langui, in manured soils, within stone enclosures growing with *Stipa ichu*, 1 April 1984, *R. Ortega, G. Lovatón and E. Guzmán CPS-0003* (OCH). Near Santo Domingo bridge [3820 m alt.], above the Apurímac River [type locality of *S. canasense*], along the route Yauri-Santo Tomas, with *Stipa ichu*, 1 April 1984, *R. Ortega, G. Lovatón and E. Guzmán CPS-0004* (CIP, OCH, plants grown from seed at Huancayo), *CPS-0005, CPS-0006* and *CPS-0008* (OCH, from the originally collected plants, topotypes of *S. canasense*).

Province Canchis: On the slopes of Sicuani, between herbs and mosses, 3700-3800 m alt., tubers white, 24 February 1939, *C. Vargas C. 9839 p.p.* (CPC, CUZ, F, US, type collection of *S. pumilum*), and *9839B* (CUZ, OCH, also designated under *Vargas 1540* as "cotype" of *S. pumilum*, the same number cited in *Las Papas Sudperuanas*, I, p. 98, 1949 as an isotype of *S. pumilum*). Above the Chapel of El Calvario, 3600-3700 m alt., about 1/2 km to the east of the Plaza de Armas of Sicuani [considered by C. Vargas as the type locality of *S. pumilum*, personal communication], March 1946, *C. Ochoa s.n.* leg. in the old Herbarium of C. Vargas C., today CUZ. (CUZ, OCH). Aguas Calientes, 4100 m alt., in the paving stones of the Cusco-Puno railroad station, 13 March 1953, *C. Ochoa 2028* (OCH, US). Sicuani, edge of cornfield, NE of city on the Sicuani-Cuzco road. March 1, 1963; *D. and V. Ugent 4013* and *4014* (WIS). Ruins of Viracocha, at Rajchi, near San Pedro, along the Puno to Cusco road, 3550 m. Amongst rocks on hill above ruins, leaf 5-jugate, narrow, dark green, flowers blue-violet. 8 April 1971, *J.G. Hawkes, J.P. Hjerting, P.J. Cribb and Z. Huamán 5087*, 2n=24 (CIP from original collection, also in CIP, from plant grown in Huancayo, white corolla, and also US, from plant grown at Sturgeon Bay, purple corolla, Wis, U.S.A., from seeds of the original collection: HHCH-5087 = *PI 473347),* and *HHCH 5088* (CIP, original collection; US, from plants grown at Sturgeon Bay, Wis., USA, taken in 1987). Aguas Calientes, 4100 m alt., at km 96 of the Cusco-Juliaca railroad line, 27 November 1977, *T. A. Johns 457* (CIP). Aguas Calientes, 4000 m alt., near station of the Cusco-Puno railroad line, associated with *S. acaule* and *S. raphanifolium*, in *puna* grassland, 24 January 1980, *C. Ochoa 13538*, 2n=24 (CIP, OCH). Aguas Calientes, 4000 m alt., *puna* between La Raya and Marangani, near paving stones of the Puno-Cusco railroad station, growing with *S. acaule* and *S. raphanifolium*, between tufts of *Stipa ichu*, 24 January 1980, *C. Ochoa 13539* (OCH). Aguas Calientes, 4050 m alt., near Puno-Cusco railroad station, heading down from La Raya toward Maranganí, among large rocks, with *Stipa ichu*, at the base of *Penicetum clandestinum*, plants very small, 8-10 cm tall, flowers purple, large, 11 March 1984, *C. Ochoa 15627*, 2n=24 (CIP, OCH, US). Borders of the Sicuani-Langui road, 3600 m alt., 15 March 1984, *C. Ochoa, Oscar and Mayhua Blanco 15685*, 2n=24 (MOL, OCH), and *15686* (CIP, MOL, OCH). Escuela Compuerta, on both sides of the Sicuani-Yauri highway, *puna* grassland, in very moist soil, 1 April 1984, *R. Ortega, G. Lovatón and E. Guzmán 0001* (OCH). 3 km from Aguas Calientes, on talus slopes along the left margins of the road to Cusco, heading down toward Maranganí, 50 m from the train sign, with *Stipa ichu* and Chaulli-quisca (= *Chuquiraga*), Kikuyo (= *Penicetum clandestinum*), April 1984, *R. Ortega, G. Lovatón and E. Guzmán CPS-0050* (OCH).

Province Chumbivilcas: Velille, 3800 m alt., about old walls, 29 May 1959, *C. Vargas C. 12895* (CUZ, OCH). Vicinity of Hacienda Miraflores, 3700 m alt., near Velille, n.v. *Atokk Apharu* (= Fox Potato), flowers light blue, articulated near calyx, 21-24 May 1975, *C. Ochoa* and *L. A. Pacheco 8692*, 2n=24 and *8693*, 2n=24 (CIP, F, MOL, NY, OCH, US, from plants propagated at Huancayo). Vicinity of Hacienda Miraflores, 3950 m alt., grasslands near Velille, along the route Livitaca-Velille, fruits round, 2.5 cm dia. with dark purple vertical stripes, 4-7 April 1978, *C. Ochoa and L. A. Pacheco 12043*, 2n=24 (GH, MOL, OCH, US).

Province Cusco: K'ayra, near Cusco, November 1928, *M. Kaufman s.n.* (WIR, type collection of *S. kaufmanii nom nud*., plants grown near Leningrad from tubers collected originally by Kaufman). Chacán, 3700 m alt., north of Cusco, growing along the edges of cultivated fields, 29 November 1936, *C. Vargas C. 609* (CUZ, LL, type collection of *S. lechnovichii* var. *latifolium* Vargas). Cusco, 12000 ft. alt. [near 4000 m alt., indefinite locality], in turf, purple flower, 4 February 1938; *D. Stafford 1243* (F). Chacán, 3600 m alt., north of Cusco, 27 January 1944, *C. Vargas C. 4067* (CUZ, LL, OCH, type collection of *S. ochoae* Vargas). Sajsaihuaman-Tambomachai, in a rocky area, 11 March 1951, *C. Vargas C. 10054* (CUZ, LL). On gravelly-rocky slopes, 4 km from Cusco on road to Pisac, 3600 m, plants low, bushy with small leaflets, flowers bluish purple, rotate, fruits round, white-speckled, 26 February 1958, *D.S. Correll and E.E. Smith P223* (K, LL, MO, NY, UC, US, USM); *P223*-sheet 2, LL). Recoleta, Cusco, on edge of fields, flowers purple with radiating white stripes, tubers round, up to 4.5 cm in diam., flesh flushed with purple, fruits ovoid, 2 cm long, dark green marked with dark green stripes, March 2, 1958, *D.S. Correll, E.E. Smith, and C. Vargas P241 p.p.* (LL, US, USM). K'ayra, in meadows and on edge of maize fields, 3150 m. April 16, 1959; *Carrillo and H. Ross 782* (MAX). 7 km from Cusco on road to Pisac, 3900 m. 17 April 1959, *Rimpau, H. Ross and C. Vargas C. 794* and *795* (MAX). Ruins of Sakksayhuaman, Inca fortress, above Cusco, ca. 3500 m, growing in rocky soil on top ledge of Inca Wall, full sun, 12 February 1963, *D.* and *V. Ugent 3504*-sheet 2 (F), *3504*-sheets 4 & 5 (WIS), and *3508*-sheets 2 & 3 (WIS). 7 km NW of Cusco on the Cuzco-Pisac road, small Inca ruin on rocky hillside facing Ft. Pucara, with *Mutisia, Calceolaria, Baccharis, Pilea*, and *Opuntia* sp., 27 February 1963, *D. and V. Ugent 3969*-sheet 3 (OCH), *3971*-sheet 3 (OCH), and *3972*-sheets 1, 2, 3, 4 and 5 (WIS). 4 km from Cusco on road to Pisac, in rocky bluff and gorge, with *Calceolaria, Galium, Cassia, Baccharis, Castilleja, Epilobium, Sisyrinchium, S. raphanifolium* and *S. canasense*, 4 March 1963, *D. Ugent 4060* (F), *4064*-sheets 1, 2, 3 (WIS), *4066*-sheets 1, 2 (WIS), *4067* (OCH), *4069*-sheet 2 (OCH), *4074*-sheet 2 (OCH), *4075* (F), and *4077*-sheets 1, 2, 3, 4, 5 (WIS). Fort Pucara, 7 km NE of Cusco, on Cusco-Pisac road, growing in crevices in the walls of the ruins, 6 March 1963, *D.* and *V. Ugent 4108* (F), and *4111*-sheets 1, 2, 3, 4, 5 (WIS). Stone quarry near Grupo Arqueólogico, 3600 m, 4.5 km N of Cusco, about mid-way among the ruins of Sakksayhuaman and Tambomachay, 6 March 1963, *D.* and *V. Ugent 4130* (CIP, WIS). Stone quarry near Grupo Arqueológico, 3600 m, 4.5 km N of Cusco (on Cusco-Pisac road), mid-way among the ruins of Sakksayhuaman and Tambomachay, 11 March 1963, *D.* and *V. Ugent 4231, 4232, 4237, 4238, 4239* (WIS), *4241*-sheet 4 (OCH), *4242*-sheets 1, 2, 3, 4 (WIS), *4243*-sheets 1, 2, 3, 4 (WIS), *4244, 4271* (WIS). Chacán, N of Cusco, 1 km above ruins of Tambomachay, type locality of *S. ochoae*, in moist mossy soil in crevices of rocks and on margins of small stream, with *Berberis, Mutisia, Calceolaria, Baccharis, Hieracium, Sisyrinchium, Bidens, Pilea, Linaria, Castilleja*, and *Gentiana*, 12 March 1963, *D. Ugent: 4277, 4279, 4280, 4281, 4287, 4288, 4289, 4295-6, 4297*-sheets 1, 2; *4298*-sheets 3, 4; *4299*-sheet 2; *4300, 4301, 4302-3, 4304-6, 4335, 4336, 4337, 4338, 4347, 4348, 4349-51, 4352, 4369*-sheet 2 (all in WIS); *4339, 4354* (OCH), and *4283* (US). Stone quarry near Grupo Arqueológico, 3600 m, 4.5 km N of Cusco (on Cusco-Pisac road) and 0.64 km E on turn-off to the ruins of Sakksayhuaman and Tambomachay), hybrid swarm of *S. megistacrolobum* and *S. canasense*, mass collections include those of the parental species, putative F_1 and F_2 segregates, 16 March 1963, *D. and V. Ugent 4439* Sheet-1 (WIS), *4443* (WIS), and *4445* sheets-1, 2 (WIS). Chacán, 3600 m, north of Cusco, type locality of *S. ochoae*, on steep xerophytic slopes with *Stipa ichu*, 1 April 1971, *C. Ochoa, C. Vargas C. and O.*

Blanco 2987 (OCH). Tambomachay, 3900-3950 m alt. Under rocks and in bushes, looks like *S. canasense* with slightly broader leaves, great variation in leaf characters and in decurrency, flower violet, 14 April 1971, *J.G. Hawkes, J.P. Hjerting, P.J. Cribb, and Huamán 5172* (CIP). Llaulli Pucyo and Uno-pascana, near Quishuarpata, highlands of Granja K'ayra, Cusco, 3400-3650 m alt., March 1974, *C. Ochoa* and *O. Blanco 5207* (OCH). Archaeological Complex of the Lake, 3600 m alt., 6 km east of the Cusco-Pisac road, at a detour before Puca Pucara, 31 January 1980, *C. Ochoa 13573*, 2n=24 (CIP, OCH, US). Between Ck'encco and Puca Pucará, 3700 m alt., plants small with leaves very dissected, associated with *Barnadesia, Astragalus, Cassia* and *Eupatorium*, 31 January 1980, *C. Ochoa 13576*, 2n=24 (CIP, MOL, OCH). Chacán, 3680 m alt., 7 km north of Cusco, among stones of a mountain slope, flowers blue-violet, large, 3.5-4.0 cm in dia., leaves varying in segmentation and and in the breadth of the leaflets, growing with *S. bukasovii* f. *multidissectum* and associated with *Barnadesia, Cassia, Sonchus, Eupatorium, Bidens, Desmodium, Calceolaria, Rumex, Astragalus, Plantgo* and other non-tuberous *Solanum* species, *Stipa, Festuca, Poa,* and *Gnaphalium*, 6 March 1980, *C. Ochoa 13696*, 2n=24 (CIP, F, OCH, US, topotype of *S. ochoae*). Quebrada de Ckajllacancha, 3780 m alt., *puna* and grasslands to the southwest and above Granja K'ayra, near Cusco, 29 March 1981, *C. Ochoa 14375*, 2n=24 and *14376*, 2n=24 (CIP, OCH).

Province Espinar: Campamento "Río Salado," 3940 m alt., on talus slopes near a stream, corolla light blue, 7-9 February 1946, *C. Vargas C. 5645* (CUZ, LL). Puente Santo Domingo, 3895 m alt., on rocky hillsides; corolla light blue, tubers long, white, 7-9 February 1946, *C. Vargas C. 5646 p.p.* (CUZ, LL, OCH). Puente Santo Domingo, 3895 m alt., in rocky areas, 7-9 February 1946, *C. Vargas C. 5648* (CUZ, OCH). Mamanhuatuc, 4200 m alt., river basin of the Apurímac, 22 January 1950, *C. Vargas C. 10526* (CUZ, LL). Hacienda Pokkera, 4500 m alt., under ledges and cliffs, 14 February 1952, *C. Vargas C. 10573* (CUZ, LL, OCH, type collection of *S. espinarense* Vargas). Near Occoruro, 3900 m alt., District of Cayani, n.v. *Atokk-papa* (= Fox Potato), in puna grassland, April, 1975, *C. Ochoa 8845*, 2n=24 (CIP, OCH, US). Pokkera, 3950 m alt., near Espinar, 4-7 April 1978, *C. Ochoa* and *L. A. Pacheco 12042*, 2n=24 (CIP, OCH, US). Apachacco, near Machu Bridge, 20 m before the bridge, on talus slopes along the left bank of the Apurímac River, District Coporaque, among *Lupinus* and *Ullucus*, 1 April 1984, *R. Ortega, G. Lovatón, and E. Guzmán CPS-0020*, 2n=24 (OCH) and *CPS-0020* (CIP, MOL, OCH, from plants grown at Huancayo). 400 m from the Sañimayo bridge, on the left bank of the road to Suycutambo, District Suycutambo, 3650 m alt., between two rocky hills, near cultivated fields growing among *Stipa ichu* and *Salvia* in moist rocky soil, 1 April 1984, *R. Ortega, G. Lovatón and E. Guzmán CPS-0023*, 2n=24 (OCH), *CPS-0023* (CIP, F, MOL, US, from plants grown at Huancayo) *CPS-0024 and CPS-0025* (OCH), *CPS-0026*, 2n=24 (OCH), *CPS-0026* (CIP, GH, MOL, OCH, US, from plants grown at Huancayo), *CPS-0027*, 2n=24 (OCH), and *CPS-0027* (CIP, OCH, US, from plants grown at Huancayo). 25 km from Paraccay along the route to Suycutambo, District Suycutambo, Espinar, on rocky talus slopes, more or less 3650 m alt., between *Stipa ichu* and forests of *Polylepis incana* on sandy soil, 1 April 1984, *R. Ortega, G. Lovatón and E. Guzmán CPS-0028* (OCH). At km 12 along the route to Tojroya, among *Stipa ichu* and *Urtica*, on sandy moist soil, 1 April 1984, *R. Ortega, G. Lovatón* and *E. Guzmán CPS-0035* (CIP, MOL, OCH, US). At km 20, road to Tojroya on sandy moist soil, 1 April 1984, *R. Ortega, G. Lovatón and E. Guzmán CPS-0037* (CIP, OCH, US), *CPS-0038* (CIP, OCH), and *CPS-0043* (MOL, OCH, US).

Province La Convención: Ccochayocc, 3800 m alt., *puna*, near the Panticalla Pass, heading down towards Quillabamba, at the margins of cultivated fields of potato, 24 March 1981, *C. Ochoa 14370*, 2n= 24 (CIP, GH, OCH, US).

Province Paruro: Aukis, 3650 m alt., Quebrada de Mismis, near Yauriski, March 1974, *C. Ochoa and O. Blanco 5208* (OCH). Between Yaurisque-Paruro, 3550 m alt., plant rosette-forming, vigorous, leaves little divided, leaflets broadly elliptical and long, corolla light purple-violet, large, 4.5 cm in dia., 1 February 1980, *C. Ochoa 13582*, 2n=24 (OCH, from plants grown at Huancayo).

Province Paucartambo: Above Huancarani, along the route Cusco-Paucartambo, 3700 m alt., 7 April 1962, *C. Ochoa 2407* (OCH). Near Huancarani, 3500 m alt., along the route Cusco-Paucartambo, 7 April 1962, *C. Ochoa 2410* (OCH, from plants grown at Universidad Nacional Agraria La Molina, Lima, in November 1962). Near Chinchibamba, 3450 m alt., along the railroad line from Paucartambo to Keros, 3 April 1971, *C. Ochoa 2988* (OCH). Ayapata, 3280 m alt., along the footpath from Paucartambo to Chinchibamba, April 1971, *C. Ochoa 3054* (OCH, from plants grown at Universidad Nacional Agraria La Molina, Lima).

Province Quispicanchis: Near Lucre, 19 November 1932, *M. Kaufman s.n.* [=*Kaufman s.n.* collected at K'ayra, Cusco in November 1928] (WIR as *S. kaufmanii*, plants propagated from seed, near Leningrad, U.S.S.R.). Along top of old stone wall, Piquillacta, 3200 m alt., flowers purple, 1 March 1958, *D.S. Correll, E.E. Smith and C. Vargas C. P238* (K, LL, US, USM, all topotypes of "*S. lechnoviczii* var. *xerophyllum*"), *P238* sheet 2 (LL). Piquillacta, Inca wall near Oropeza. 3200 m, amidst ruins and on surrounding rocky hillsides, with *S. raphanifolium* and *S. canasense, 2* March 1962, *D. and V. Ugent 4038*-sheet 1 (WIS); *4039-sheets 1, 2, 3* (WIS); *4040* (F); *4041*-sheet 3 (OCH) and *4044* (WIS). Viscachani, 4000 m alt., highlands of Pitumarca, among stones, in *puna* grassland, plants very small, 7-10 cm tall, resembling *S. acaule*, flowers large, 3.5 cm in dia., 20 February 1972, *C. Ochoa 3249* (OCH). On the slopes of a mountain northwest of the Huacarpay lagoon, 3230 m alt., near Lucre, in poor, dry rocky soil; in thickets of *Nicotiana glauca, Opunta exaltata, Erdisia* sp., some non-tuberous *Solanums* and small trees of *Schinus molle*, 30 January 1980, *C. Ochoa 13568*, 2n=24 (OCH). Near paradero Jaucat, 3500 m alt., on rocks amid bromeliads and *Barnadesia*, 16 February 1980, *C. Ochoa 13622* (OCH). Near Jaucat, 3500 m alt., between Chuquicahuana and Puente Cusipata, plants with leaves variously dissected, 12 March 1980, *C. Ochoa 13724*, 2n=24 (OCH) and *13725*, 2n=24 (CIP, OCH). Vicinity of the ruins of Tipón, near Oropeza, 3800 m alt., berries ovoid, green with purple stripes and white dots, 29 March 1981, *C. Ochoa 14381*, 2n=24 (CIP, F, OCH, USM). Jaucat, 3500 m alt., near Paucarpata, District of Urcos, along the route Cusco-Puno, 20 March 1984, *C. Ochoa 15669* (OCH).

Province Urubamba: Between Peñas and Ck'osñiritti, 3700 m alt., in shrubby thickets on hillsides, 23 March 1946, *C. Vargas C. 5958* (CUZ, LL, OCH, type collection of *S. amabile* Vargas). Pumahuanca, 2900-3000 m alt., in rocky soil, 24 January 1949, *C. Vargas C. 7653* (CUZ, LL). Pumahuanca, 4300 m alt., a little before Pacchaj, among stones, plant up to 40 cm tall, corolla white with deep blue star, 14 February 1949, *C. Vargas C. 7836* (CUZ, type collection of *S. canasense* var. *alba*). Above Urubamba, km 25 on the Urubamba-Izcuchaca road. 3200 m. Dry, sandy, steep cliff almost devoid of any other vegetation, 9 March 1963, *D. and V. Ugent 4194* (F, WIS). Lower end of Quebrada Pumahuanca, deep side valley of Urubamba River, ca. 2-4 km NW of Urubamba, 72°3' W, 13°12' S, 3200-3600 m, 9 March 1963, *D. and V. Ugent 4208*-sheets 1, 2 (WIS). Huajratanga, between Peñas and Kosniritti, on shrubby slopes, 3700 m alt., 12 April 1970, *C. Ochoa 2729* (OCH, topotype of *S. amabile*), *2730* and *2731*, 2n=24 (OCH). Ckosñirit'i, 3800 m alt., in rocky foothills at snowline, near shrubby thickets, plants very young, tubers minute, 7-10 m in dia., 10 May 1975, *C. Ochoa 7819* (OCH). Sapansachayocc, 3750 m alt., facing the snow-capped mountain of Ck'osñiritti, heading up the quebrada toward Panticalla Pass, 10 May 1975, *C. Ochoa 7820*, 2n=24 (CIP, OCH, from plants grown at Huancayo). Ichu Cancha, 3600 m alt., District Chincheros, among old stone enclosures, corolla blue-violet, 3 cm in dia., berries ovoid, marked with purple stripes and a sprinkling of white dots, 14 May 1975, *C. Ochoa 8083*, 2n=24 (CIP, GH, MOL, NY, OCH, US, USM). Wajratankka, 3780 m alt., near Ck'osñiritti, above Peñas, corolla light violet, 3.5 cm in dia, in shrubby thickets formed by *Barnadesia, Ecremocarpus, Calceolaria, Senecio, Bidens, Salvia, Ranunculus, Stipa*, in *puna*, 22 March 1981, *C. Ochoa 14352*, 2n=24 (CIP, F, GH, MOL, NY, OCH, US). Wajratankka, 3780 m alt., above Peñas and the lower levels of the mountain snowfields of Ck'osñiritti, plants small, 20-30 cm tall, rosette-forming, very pubescent, corolla purple-violet, 3-4 cm in dia., 22 March 1981, *C. Ochoa 14353*, 2n=24 (CIP, MOL, F, GH, NY, OCH), and *14354* (CIP, OCH). Pass or Puerto Málaga, 3750 m alt., along the route Ollantaytambo-Quillabamba, in shrubby thickets, about field stones, 24 March 1981, *C. Ochoa 14359* and *14360*, both with 2n=24 (CIP, OCH, US). Peñas, 3700 m alt., near Málaga Pass, among large rocks and in shrubby thickets, March 1981 *C. Ochoa 14371* and *14372*, 2n=24 (CIP, F, NY, OCH, US). Quebrada de Pumahuanca, 2980 m alt., near Urubamba, very rare, 20-30 March 1983, *C. Ochoa 15109* (OCH). Wajratankka, 3750 m alt., near Ck'osñiritti, only mature berries were collected, (without date), *C. Ochoa S-26* (= *PI-365353*), 2n=24, and 10 April 1966, *S-33*, (= *PI-365355*), 2n=24 (US, from plants grown at Sturgeon Bay, Wis., U.S.A., in 1987).

Locality Indefinite

Specimen *CPC-0025*, possibly collected originally by S. M. Juzepczuk near Cusco in 1928. This specimen was prepared for the herbarium by J.G. Hawkes from a plant grown near Leningrad, U.S.S.R. in 1938. Determined as *S. aracc-papa* without reference to the collector nor the precise locality of the original collection (CPC).

Department Huancavelica

Province Angaraes: Vicinity of Lircay, 3000 m alt., plants small, 25 January 1958, *C. Ochoa 2145* (OCH). Cerro Rumichaca, 3800 m alt., about 5 km from Lircay, among rocks, 11 February 1979, *C. Ochoa 13174* , 2n=24 (CIP, F, GH, NY, OCH, US). 15 km from Lircay to La Constancia. [No date]; *J.P. Hjerting 5444* (= *PI-473492*), 2n=24 (OCH, from plants grown at Sturgeon Bay, Wis., U.S.A.).

Province Churcampa: District Paucarbamba, Huachuapampa, 3800 m alt., along the borders of cultivated fields of potato, dwarf plants, 8-10 cm tall, flowers deep blue, 27 March 1996, *C. Ochoa and A. Salas 16266* (CIP, OCH). District Paucarbamba, Rancho, 3600 m alt., associated with *Stipa* sp., 27 March 1996, *C. Ochoa and A. Salas 16267* (CIP, MOL, OCH, USM). District Coris, Romeropata, 3400 m alt., above Pampalca, along the edges of cultivated fields of Olluco and Oca, among shrubs of "Mutuy" (= *Cassia*), 27 March 1996, *C. Ochoa and A. Salas 16268* (CIP, MOL, OCH). District Coris, Santa Rosa, 3600 m alt., between Pampalca and the mountain crest of Tulpacancha, 27 March 1996, *C. Ochoa and A. Salas 16269* (CIP, MOL, OCH, USM). District Coris, Santa Rosa, 3800 m alt., in an open field near the Chinchicocha lagoon, 27 March, 1996, *C. Ochoa and A. Salas 16270* (CIP, OCH) and *16271* (within forests of *Polylepis* sp., OCH).

Province Huancavelica: Quebrada west of Huancavelica, crevices within boulders and cliffs, in high *puna*, 3900 m, 10 March 1939, *Stock and Horton 10841* (F). Cerro Larmes, 3400 m alt., east of Conaica, in clay soil, n.v. *Fox Potato,* 14 March 1951, *O. Tovar 171* (LL, OCH, US). Jaullapa, above Conaica, 3900-4000 m alt., *puna* grassland, flowers blue, n.v. *Atokk-Papa*, 18 March 1951, *O. Tovar 221* (LL, USM). Cerros de Laria, 3850-3900 m alt., 8 km from Conaica, grassland, flowers blue, 30 March 1952, *O. Tovar 896* (LL, OCH). Quishuar, 3700 m alt., near km 50 of the road Huancayo-Iscuchaca-Huancavelica, 11 February 1979, *C. Ochoa 13171*, 2n=24 (CIP, OCH, US). Near km 35 of the road Huancavelica-Lircay, 3700 m alt., plants with leaves varying in dissection, flowers deep blue, 3.0-3.5 cm in dia., 11 February 1979, *C. Ochoa 13173 p.p.*, growing with *S. bukasovii* f. *multidissectum* (CIP, F, MOL, OCH, US, USM). On stone walls at the entrance of the city of Huancavelica via the highway Los Libertadores, 3600 m alt., [without date], *L.E. López 1868* (CIP, OCH), *1919, 1920* and *1921* (CIP).

Province Pampas: District Ahuaychu, Suiturumi, 3300 m alt., on rocky cliffs with a lush understory of *Opuntia tunicata* and shrubs of *Dunalia lycloides* and *Ambrosia peruviana*, 29 March 1996, *C. Ochoa and A. Salas 16274* (CIP, MOL, OCH). District Huaribamba, Tongos, 3400 m alt., 29 March 1996, *C. Ochoa and A. Salas 16275* (CIP, MOL, OCH).

Province Tayacaja: Hacienda Huari, 3900 m alt., in rocky or clay soil, flowers purple, 6 April 1959, *O. Velarde 7328* and *7333* (OCH). 20 km beyond La Mejorada on the road to Huancayo, 3000 m, amid *Kageneckia lanceolata, Tecoma stans, Dodonea,* etc. April 28, 1959, *Pérez, Rimpau, Ross, and Vargas 983* (MAX). 4 km before Tablachaca, 3000 m alt., along the route Huancayo-Iscuchaca-Huancavelica, 11 February 1979, *C. Ochoa 13170*, 2n=24 (CIP, MOL, OCH, USM). Condenadohuayo, 3600 m alt., between Pampas and Rundus, along the route to Pusqui, flowers deep blue, 26 March 1996, *C. Ochoa and A. Salas 16260* (CIP, MOL, OCH, USM). District Colcabamba, Puquiac, 3300 m alt., about 5 km north of Tocas, on a great calcareous mountain within a mantle of *Loasa* sp., 26 March 1996, *C. Ochoa and A. Salas 16262* (CIP, MOL, OCH, USM). Malpaso, 3700 m alt., between Carpapata and Milpo, near cultivated fields of potato, flowers deep blue, 27 March 1996, *C. Ochoa and A. Salas 16264* (CIP, MOL, OCH, USM).

Department Huánuco

Province Dos de Mayo: Highlands of Chupán, 3500 m alt., April 1976, *C. Ochoa 10977*, 2n=24 (CIP, OCH, from plants grown at La Molina, Lima and

CIP, from plants grown at Huancayo and at Sturgeon Bay, Wis., U.S.A.). Among the ruins of Huánuco Viejo, 3500 m alt., 23 April 1967, C. *Ochoa S-28*, 2n=24 (CIP, from plants grown at Sturgeon Bay, Wis., U.S.A.).

Province Huamalíes: Huejroccocha, 4000 m alt., 10 km before Tantamayo, along the route Chavín de Pariarca-Tantamayo, in *puna* grasslands, 24 April 1961, C. *Ochoa 2356*, 2n=24 (OCH). Urpish, 3400 m alt., District Jircán, April 1961, C. *Ochoa 2390*, 2n=24 (OCH, from plants grown at La Molina). Lower levels of Cerro Llacuy, 3450 m alt., near Llata, April 1961, C. *Ochoa 2395* (OCH, from plants grown at Universidad Nacional Agraria La Molina, Lima, in October 1961).

Department Junín

Province Concepción: Santa Rosa de Ocopa, 3300 m alt., near Concepción, February 1947, C. *Ochoa 54* (LIL, OCH). Between stone enclosures near Hotel Huaychulo, 3300 m alt., between Huaychulo and Ocopa, Concepción, February 1947, C. *Ochoa 56* (CUZ, OCH, US). Vicinity of Ocopa, 3300 m alt., 6 km from Concepción, February 1947, C. *Ochoa 57* (CUZ, OCH). In grasslands at Hacienda Runatullo, near the hamlet, 3500-3600 m alt., along the route Comas to Satipo, flowers blue violet, February 1947, C. *Ochoa 60* (CUZ, OCH). Punas de Chijchi, 3700-3800 m alt., between kms 17-19 of the road Concepción-Satipo, flowers large, showy, deep blue, abundant colonies, March 1947, C. *Ochoa 70* (CUZ, OCH). Near Concepción, 3300 m alt., March 1947, C. *Ochoa 78* (LIL, OCH). Carmen Cerro, 3700-3800 m alt., fronting kms 22-24 of the road Concepción-Satipo, among rocks and at the base of a cave, corolla blue-violet, March 1947, C. *Ochoa 83* (OCH, US). Ingenio, 3300 m alt., near Criadero de Truchas, 6 km from Concepción, March 1947, C. *Ochoa 91* (OCH). Qebrada de Iscos, 3300 m alt., near Ocopa, April 1947, C. *Ochoa 102* (OCH). Between San Antonio and Chijchi, 3700 m alt., at km 18 of the road Concepción-Satipo, associated with *Stipa, Berberis, Chuquiraga,* plant small, some rosette-forming, flowers deep blue, 2 February 1950, C. *Ochoa 792* (OCH). Vicinity of Huaychulo, 3300 m alt., between Concepción and Ocopa, 24 March 1952, C. *Ochoa 1398* (OCH). Highlands of Chijchi, 3850 m alt., along the route Concepción-Comas-Satipo, 29 January 1953, C. *Ochoa 1988* (OCH). Runatullo Pampa, 3500-3600 m alt., *puna* near Hacienda Runatullo, along the route Comas-Satipo, 20 January 1953, C. *Ochoa 2005* (OCH). Toldo Pampa, 3575 m alt., along the route Comas-Satipo, heading down from Runatullo to Calabaza, on rock piles, with weeds, 30 January 1953, C. *Ochoa 2016* (OCH). Vicinity of the Hotel Huaychulo, 3300 m alt., near Concepción, 17 January 1958, C. *Ochoa 2143* (OCH). Huaychulo, near Concepción, along stream, 3300 m April 29, 1959, C. *Ochoa and H. Ross 1020* (MAX). On brushy stream bank above Concepción, 3500 m, flowers deep lavender, rotate-pentagonal, 16 March, 1960, *D.S. Correll and E.E. Smith P733* (LL, US). Heading down from Hacienda Runatullo to Carrizal, 3600 m alt., in *puna* grasslands covered with *Stipa ichu*, 25 January 1961, *C. Ochoa 2341* (OCH). Near Carrizal, 3200 m alt., between Hacienda Runatullo and Carrizal, along the route to Satipo, 31 March 1963, *C. Ochoa 2472* (OCH, from plants grown at the Experimental Station at Mantaro, near Huancayo). Cóndor-Senca, 3910 m alt., District Comas, on rocky talus slopes in moist soil, 8 April 1972, *Z. Huamán and J. Bryan 304* (CIP, OCH). Between Utulo and Antacocha, 3480 m alt., in *puna* grasslands and among large rocks, associated with *Stipa, Senecio, Plantgo* and *Berberis*, February 1973, *C. Ochoa 3587*, 2n=24 (CIP, OCH, US, type collection of *S. antacochense* Ochoa). Near Yanacocha, 3800 m alt., above Chijchi, along the route Concepción-Comas-Satipo, 2 March 1975, *C. Ochoa 7360* and *7361* (OCH). Above Ingenio, near the trout hatchery, 3400-3500 m alt., about 6 km east of Concepción, December 1977, *C. Ochoa 11786*, 2n=24 (CIP, OCH). Azul Ccocha, 3800 m alt., District Andamarca, 6 km east of Runatullo, along the route of the railroad line to Andamarca, 22 January 1978, *C. Ochoa 11850*, 2n=24 (CIP, GH, NY, MOL, OCH, US). Taptapa, 3800 m alt., above Sayhua, along the route Runatullo-Andamarca, 22 January 1978, *C. Ochoa 11851*, 2n=24 (CIP, OCH). Taptapa, 3800 m alt., above Sayhua, along the Runatullo-Andamarca railroad line, 22 January 1978, *C. Ochoa 11852*, 2n=24 (CIP, OCH). Tahualtuco, 3600 m alt., at the bottom of the Tuctuca Pass to Runatullo and Calabaza, along the route Comas-Satipo, 22 January 1978, *C. Ochoa 11853* (OCH). Alayo, 3300 m alt., between Ocopa-Huaychulo, near Concepción, 2 February 1978; *C. Ochoa 11875*, 2n=24 (CIP, F, NY, OCH, US). Near Huaychulo, 3250 m alt., April 1978, *C. Ochoa 12511* (OCH). Chijchi, 3900 m alt., April 1978, *C. Ochoa 12512* (OCH). Huaychulo, 3200 m alt., April 1978, *C. Ochoa 12513* (OCH). Near Ingenio, 3600 m alt., April 1978, *C. Ochoa 12514* (OCH). Santa Rosa, 3400 m alt., April 1978 *C. Ochoa 12515* (OCH). Santa Rosa, May 1978, *C. Ochoa 12521* (OCH). Piñas, Cochas, May 1978, *C. Ochoa and A. Salas 12522* (OCH). Highlands of Cumaspujio, 3800 m alt., 2 km above Chijchi, along the route Concepción-Comas-Satipo, plants very small, rosette-forming, resembling *S. acaule*, 31 January-3 February 1984, *C. Ochoa 15314* (OCH). Along the route Santa Rosa de Ocopa to the Hotel Huaychulo, 3300 m alt., *Z. Huamán 47* (CIP, OCH).

Province Huancayo: Acopalca, 3650 m alt., February 1948, *J. Soukup 3689* (F). La Legua, 3250 m alt., about 6 km from Huancayo, along the route Huancayo-San Jerónimo, amid *Agave* and *Opuntia exaltata*, 26 February 1946, *C. Ochoa 681* (OCH). Lower levels of the hills in the vicinity of Hualhuas, 3280 m alt., Mantaro Valley, 4 March 1949, *C. Ochoa 683* (OCH, US). Pasos, near Huancayo, passed Huayucachi, 3100 m alt., 20 March 1949, *C. Ochoa 719* (GH, OCH, US). Vicinity of Hacienda Acopalca, 3650 m alt., in *puna*, 18 February 1951, C. *Ochoa 794* (OCH). Chamisería Canyon, 3400 m alt., along the route Huancayo-Acopalca, 18 February 1951, C. *Ochoa 999*, 2n=24 (GH, OCH). Huancayo, 3250 m alt., March 1951, *J. Soukup 3986* (F). Acopalca Canyon, 3550 m alt., between Huancayo and Hacienda Acopalca, flowers blue, large, 20 January 1952, C. *Ochoa 1393* (OCH). Km 337 from Lima, between Huancayo and La Mejorada, 3700 m, 4 April 1953, *Petersen and Hjerting 1370*, 2n=24 (= PI-210051, from living plants grown at Strugeon Bay, Wis., U.S.A., Summer 1987, US). Km 358 from Lima, between Huancayo and La Mejorada, 3650 m, 4 April 1953, *Petersen and Hjerting 1378*, from plants grown at Sturgeon Bay, U.S.A., Summer 1987, in herbarium at Sturgeon Bay. Hacienda Acopalca, 3900 m alt., flowers purple, 3 April 1959, O. *Velarde 7177* (OCH). 10 km from Acostambo to Huancayo, 3400 m alt., April 28, 1959, *Perez, Rimpau, Ross and Vargas 989* (MAX). Middle flanks of the northeastern side of the peak of Huaytapallana, 4000 m alt., heading up from Pahual, with *Stipa ichu*, 14 March 1960, C. *Ochoa 2283, 2284, 2285* and *2286* (OCH). Huari, 3650 m alt., among boulders, flowers large, lavender, 15 March 1960, *D.S. Correll and E.E. Smith P728* (LL, MO, UC, US). Queros, near Huancayo, 17 January 1969, *J. Soukup 6175* (OCH, USM). Huancayo, 3550 m alt., in grasses along stream on road to Central Cattle Farm, flowers purple, rotate-pentagonal, 16 March 1960, *D.S. Correll and E.E. Smith P731* (LL). Lower levels of Cerro Huaytapallana, 3800 m alt., near Huancayo, May 1972, C. *Ochoa 3667* (OCH) and (OCH, plants grown from seed at the Granja K'ayra, Cusco). Cerro Huaytapallana, 3800 m alt., May 1972, C. *Ochoa and P. López* C. *3668* (OCH, from plants grown at the Granja K'ayra, near Cusco). Huancayo, 3250 m alt., in swampy-rocky soil, flowers purple, 12 December 1960, *P. Hjerting 1058* (USM). Near Usibamba, 3600 m alt., District Chupaca, 15 January 1978, C. *Ochoa 11841*, 2n=24 (CIP, MOL, NY, OCH, US). Lower levels of Huaytapallana, 3700 m alt., 1 February 1978, *Ochoa 11870*, 2n=24 (CIP, OCH, US). Tayapata, 3800 m alt., lower levels of Huaytapallana, along the route Huancayo-Pahual-Chirifruta, 1 February 1978, C. *Ochoa 11871*, 2n=24 (CIP, OCH) and *11872*, 2n=24 (CIP, F, NY, OCH, US). Middle levels of Huaytapallana, 4200 m alt., 1 February 1978, C. *Ochoa 11873*, 2n=24 (CIP, OCH). Acopalca, 3650 m alt., 1 February 1978, C. *Ochoa 11874*, 2n=24 (CIP, MOL, OCH, from plants grown at Huancayo). Ascending from Pahual to Huaytapallana, 3900 m alt., plants rosette-forming, very small, resembling *S. acaule*, 22 January 1979, C. *Ochoa 13113*, 2n=24 (CIP, OCH) and *13114*, 2n=24 (OCH). Between Huaytapallana and Acopalca, 4000 m alt., 22 January 1979, C. *Ochoa 13115*, 2n=24 (CIP, GH, MOL, NY, OCH, US). Acopalca, 3750 m alt., along the route to Huancayo, 22 January 1979, C. *Ochoa 13116*, 2n=24 (CIP, F, GH, MOL, NY, OCH, US). Slopes of Auquillo Ayllo, 3500 m alt., to the east of

Pahual, along the route Huancayo-Huaytapallana and above the Yana Cocha lagoon, in rocky soil, 6 April 1981, *C. Ochoa and A. Salas 14407*, 2n=24 (CIP, F, NY, OCH, US, from the originally collected small plants that were grown in Huancayo). Lower levels of Cerro San Cristobal, 3400 m alt., to the west of Chongos, Mantaro Valley, tubers oval-flattened, 5 cm long, light brown to whitish, 31 January 1984, *C. Ochoa 15310*, 2n=24 (CIP, OCH). Ataucusi, 3700 m alt., near the hydroelectric plant of Huarisa, near Huancayo, 31 January-3 February 1984, *C. Ochoa 15311*, 2n=24 (CIP, OCH). Between Chaquicocha and Usibamba, along the route to Ckeru, 3800 m alt., about 40 km from Huancayo, 31 January 1984, *C. Ochoa 15312*, 2n=24 (OCH). Queru or Ckeru, 3800 m alt., near Chaquicocha, 31 January 1984, *C. Ochoa 15313*, 2n=24 (OCH, from plants grown in the greenhouse at Huancayo).

Province Jauja: Near Jauja. 1935, *E.A. Abbot s.n.* (WIS.R No. K-9, type collection of *S. abbottianum* Juz., from plants grown from seed near Leningrad, U.S.S.R., taken in 1936). Government Trout Hatchery, in Indian garden near Concepción in Mantaro Valley, 3500 m, 9 January 1945, *W. H. Hodge 6223* (US). Cerro Gloria Malca, 3500 m alt., 1 km in a straight line (air distance) from Jauja, very rare, this specimen is the one closest to the type collection of *S. abbottianum* (WIS K-9), February 1947, *C. Ochoa 55* (OCH). Tripa del Monseñor, 3300 m alt., heading down from Chijchi toward Comas via the highway Concepción-Comas-Satipo, February 1947, *C. Ochoa 58* (CUZ, OCH). Vicinity of Comas, in the environs of the village, 3500 m alt., plants very small, rosette-forming, February 1947, *C. Ochoa 59* (CUZ, OCH). Quebrada de Iscos, 3300 m alt., near Apata, in rocky soil, flowers deep blue-violet, 14 February 1948, *C. Ochoa 277* (OCH). Near Acolla, 3450 m alt., along the route Jauja-Tarma, corolla light blue, 3.5 cm in dia., growing within a wheat field, 24 March 1952, *C. Ochoa 1399* (OCH). Near the main house of Hacienda Yanamarca, 3500 m alt., along the route Jauja-Tarma via Lomo Largo, 24 March 1952, *C. Ochoa 1400* (OCH). Vicinity of Hacienda Yanamarca, 3400-3500 m alt., along the route Jauja-Lomo Largo-Tarma, 3 March 1953, *C. Ochoa 1981* (OCH). Highlands near Tripa del Monseñor, 3840 m alt., along the route Concepción-Comas-Satipo, 29 January1953, *C. Ochoa 1994* (OCH). Vicinity of Hacienda Runatullo, 3450 m alt., heading down from Comas to Satipo, 30 January 1953, *C. Ochoa 2002* (OCH). Lower levels of Carampa, 3600 m alt., near km 30 of the road Jauja-Acolla-Tarma, 25 March 1953, *C. Ochoa 2024* (OCH). Quebrada de Huaspi, 3650 m alt., near Jauja, heading up to the ruins of Tunan Marca, plants small, rosette-forming with leaves well divided, 23 January 1958, *C. Ochoa 2144* (OCH). On the upper slopes of Carampa, 4000 m alt., along the route Jauja to Hacienda Casablanca, with *Stipa* and *Berberis*, 3 March 1960, *C. Ochoa 2282* (OCH). Km 18 on road between Jauja and Tarma, 3550 m, flowers deep lavender, rotate-pentagonal, March 17, 1960; *D.S. Correll and E.E. Smith P749* (LL). Km 25 on road between Jauja and Tarma, 3850 m, among piles of rocks in cultivated fields, flowers large, dusty lavender, rotate, fruits green, marked with purple stripes, 2.5-3.0 cm long, 17 March 1960, *D.S. Correll and E.E. Smith P750* (LL, US). Km 36 on road between Jauja and Tarma, 4100 m, about ledges and among low shrubs of altiplano, flowers lavender, March 17, 1960, *D.S. Correll and E.E. Smith P752* (LL, MO, NY). Facing Pachacayo, 3800 m alt., 23 February 1975, *C. Ochoa 7362* (OCH). Near Pachacayo, 3650 m alt., along the route La Oroya-Jauja, among large rocks with *Stipa, Cajophora* and *Rumex*, March 1975, *C. Ochoa 7437* (OCH). Near Pachacayo, 3700 m alt., borders of the road Oroya-Jauja, March 1977, *C. Ochoa 11292*, 2n=24 (CIP, F, GH, MOL, NY, OCH, US). Between km 30-31 of the road Oroya-Huancayo, before Pachacayo, 3500 m alt., 24 March 1977, *C. Ochoa 11337*, 2n=24 (CIP, OCH, USM). Vicinity of Jauja, near the Jauja-Yanamuclo road, 3450 m alt., 1 February 1978, *C. Ochoa 11876*, 2n=24 (CIP, F, NY, OCH, US). Between Paca and Piscapujio, 3450 m alt., facing Jauja, corolla large blue-violet, in small woods formed by *Mutisia, Opuntia exaltata, Cassia* and *Salpichroa*, 8 February 1979, *C. Ochoa 13164*, 2n=24 (CIP, NY, OCH, US, WIS). Ucuchupa, 3580 m alt., near Los Molinos, about 7 km to the east of Jauja, along the route Jauja-Masma, along the right bank of the Queros River, growing on a sloping escarpment among shrubs of *Cassia, Banadesia* and plants of *Puya, Ranunculus, Bidens* and *Stipa ichu*, near cultivated fields of potato, 9 February 1979, *C. Ochoa 13166*, 2n=24 (CIP, F, NY, OCH, US). Jalocancha, 3580 m alt., between Jauja and Los Molinos, 4 km east of Jauja, n.v. *Pishu Akshu* (= Bird Potato), flowers blue-violet, 9 February 1979, *C. Ochoa 13167*, 2n=24 (CIP, F, NY, OCH, US). Queru, 3590 m alt., District Molinos, among shrubs of *Cassia*, on very steep slopes. Cytologically a triploid, 9 February 1979, *C. Ochoa 13168*, 2n=36 (CIP, F, GH, MOL, NY, OCH, US). Quebrada Quichuay-Ingenio, 3450 m alt., near Concepción, in forests of *Buddleja, Polylepis, Alnus* and *Cassia*, 10 February 1979, *C. Ochoa 13169*, 2n=24 (CIP, OCH, US). Yahuashpuquio, 3800 m alt., heading up from Canchayllo to Pachacayo, 26 March 1982, *C. Ochoa and A. Salas 14646*, 2n=24 (CIP, MOL, OCH, US). Highlands of the Cooperative Tupaj Amaru, near the Piñacochas River, 3750 m alt., District Pachacayo, April 1982, *C. Ochoa 14732*, 2n=24 (CIP, MOL, NY, OCH, US). Quebrada de Huaspe, 3400 m alt., about 5 km northwest of Jauja, on the ascent of Huaspe toward Marco, among large limestone pieces, 30 January 1984, *C. Ochoa 15305*, 2n=24 (OCH). Between Tingo Pajcha and Huachón, along the route of the road Jauja-Tarma, 3500 m alt., above Yanamarca, on rocky hillsides among *Solanum lycioides* and *Opuntia exaltata*, associated with various Composites and abundant *Verbena sp.*, 31 January-3 February 1984, *C. Ochoa 15315* (OCH).

Province Junín: Near Ondores, 4200-4300 m, in a rocky area and grassland, 9 January 9 1949, *R. Ferreyra 5226* (USM).

Province Satype: Toldopampa, 3400 m alt., descending by highway from Runatullo to Calabaza and Satipo, 22 January 1978, C. *Ochoa 11854*, 2n=24 (CIP, OCH, US).

Province Tarma: Vicinity of Tapo, 3500 m alt., along the route Palca-Hacienda Maco, in sandy-clay soils, flowers large, 4.5 cm dia., blue-violet, 6 March 1948, C. *Ochoa 300* (OCH). Caripa, 3800 m alt., near km 213 of the road La Oroya-Cerro de Pasco, in *puna* grassland, plants rosette-forming, small, pubescent, flowers large, blue, 14 March 1951, C. *Ochoa 1008* (GH, OCH). Quebrada de Capia, near Tarma, ca. 2800-3000 m alt., in shrubby thickets associated with native pasture grasses, *Opuntia, Lupinus*, etc., n.v. *"Papa de los Gentiles,"* plant slender, glabrous or glabrescent, leaflets narrow, flowers light blue-violet, 20 February 1952, C. *Ochoa 1396* (OCH). Heading up Quebrada de Capia, near Tarma, 3000-3200 m alt., 20 February 1952, C. *Ochoa 1397* (OCH). Cerro de Capia, 3200 m alt., near Tarma, above Hacienda Capia, 11 February 1953, C. *Ochoa 2019* (OCH). 5 km from La Oroya toward Junín, 3750 m alt., 9 April 1953, *Peterson and Hjerting 1337* (LL), *1337-1 and 1337-3* (LL, US, from plants grown at Sturgeon Bay, Wis., U.S.A.). Between Oroya and Tarma, 3800 m alt., a few km past La Oroya, plant with few tubers, flowers deep purple, 14 January 1955, O. *Velarde 5567* (OCH). Near km 206 of the route La Oroya to Cerro de Pasco, 3900 m alt., along the edges of a mountain stream, 18 March 1960, *D.S. Correll and E.E. Smith P788* (LL). Between Tarma and La Oroya, 3700 m alt., December 1960, C. *Ochoa S-15*, (OCH, from plants grown at Sturgeon Bay, Wis., U.S.A.). Above the main house of Hacienda Maraynioc, 3800 m alt., in shrubby thickets, 27 January 1961, C. *Ochoa 2348* (OCH). Casaracra, 3800-3900 m alt., in sandy-rocky soil with *Stipa ichu*, in *puna* grassland, 7 March 1977, C. *Ochoa and A. Salas 11301*, 2n=24 (CIP, OCH, US, plants propagated at Huancayo from the original tubers). Between detour of the road Jauja-Tarma, via Lomo Largo and the main house of Hacienda Cachicachi or Casablanca, 3700 m alt., in grasslands, 22 January 1978, C. *Ochoa 11844*, 2n=24 (CIP, OCH, US). Between Hacienda Maraynioc and Bellavista, 3750 m alt., near the highest pass, entering by the detour of the road Tarma-Palca to Maraynioc, 27 January 1979, C. *Ochoa 13123*, 2n=24 (CIP, F, MOL, OCH). Above Bellavista, 3000 m alt., entering by the detour of the Tarma-Chanchamayo road to the highlands of Palca, toward Hacienda Maraynioc, 27 January 1979, C. *Ochoa 13121*, 2n=24 (CIP, F, GH, MOL, NY, OCH, US). Between Bellavista and Hacienda Maraynioc, 3400 m alt., 27 January 1979, C. *Ochoa 13124*, 2n=24 (CIP, GH, MOL, NY, OCH, US). About 1 km south of Hacienda Marainioc, 3600 m alt., in shrub forests, in black soil, 27 January 1979, C. *Ochoa 13125*, 2n=24 (OCH, USM). Near Palpa, 2900 m alt., about 2 km before Palca, heading up the highway of San Ramón toward Tarma, plants scarcely 15 cm tall, among shrubs of *Solanum lycioides* and *Agave* sp., 5 February 1979, C. *Ochoa 13163*, 2n=24 (CIP, OCH). Between Pajcha and Casaracra, 3850 m alt., before the junction of the Cerro de Pasco road with the Tarma highway, December 1981, *C. Ochoa 14499*, 2n=24 (CIP, OCH, US). Esperanza, 3300 m alt., between Palca and Maraynioc, in shrubby thickets, 3 February 1984, C. *Ochoa 15306*, 2n=24 (CIP, OCH).

Province Yauli: Vicinity of La Oroya, in cultivated fields, 3050-4260 m alt., 1918, *M. Kalenborn and A. S. Kalenborn 7* (NY, US). Oroya. November 30, 1924, *F. L. Stevens 9* (US). Midway between La Oroya and Paccha, 3750 m alt., among low shrubs and grasses on long low ledges, flowers bright lavender, large, rotate, 15 March 1960, *D.S. Correll and E.E. Smith P726* (LL, NY, US, USM). Pucapuca, 3800-3950 m alt., above the cemetery of Chacapalpa, associated with *Stipa ichu*, 31 January 1978, *C. Ochoa 11866*, 2n=24 (CIP, OCH, US). Chacapalca, May 1978, *C. Ochoa and A. Salas 12520* (OCH). Santa Rosa, 3800 m alt., near detour of the La Oroya road to Cerro de Pasco and Huánuco, in grassland, December 1981, *C. Ochoa 14498*, 2n=24 (CIP, OCH, US). 3 km east of Pachacayo, ca. 3600 m alt., 31 January-3 February1984, C. *Ochoa s.n.* (OCH, from a small plant originally transplanted and grown at Huancayo).

Department Lima

Province Cajatambo: Between Matichacra and Michimachay, 3300 m, heading up the highway Churín-Oyón, 12 April 1960, C. *Ochoa 2296* and *2298* (OCH). Near Jirimachay, 3800 m alt., along the route Oyón-Cajatambo, 14 April 1960, C. *Ochoa 2299* (OCH). Pomaca, 3700 m alt., along the Oyón-Cajatambo railroad line, 14 April 1960, C. *Ochoa 2300* (OCH). Near Gazuna, 3500 m alt., along the Oyón-Cajatambo railroad line, 14 April 1960, C. *Ochoa 2301* (OCH). Macnacota, 3200 m alt., a little before Cajatambo, entering along the railroad line from Oyón, 14 April 1960, C. *Ochoa 2302* (OCH). Matichacra, 3400 m alt., heading up the Churín-Oyón highway, May 1972, C. *Ochoa 3663* (OCH, plants grown from seed at the Universidad Nacional Agraria La Molina, Lima, in June 1973). Near Macnacota, 3500 m alt., along the Oyón-Cajatambo railroad line, May 1972, C. *Ochoa 3664* (OCH, from a plant grown from tubers at the Universidad Nacional Agraria La Molina, Lima, in 1973). Tunaspata, 3280 m alt., between Churín and Oyón, April 1978, C. *Ochoa and A. Salas 12572* (CIP, MOL, OCH). Highlands of Quichas, 4100 m alt., about 10 km north of Oyón, along the route Oyon-Cajatambo, 31 January 1979, C. *Ochoa 13147*, 2n=24 (CIP, OCH, plants grown from tubers at Huancayo). Crus-circa, 3400 m alt., above Utcas, between Cajatambo and Cajamarquilla, 12-18 April 1982, *C. Ochoa 14673*, 2n=24 (CIP, MOL, OCH, plants grown from tubers). Matichacra, 3550 m alt., between Oyón and Cajatambo, December 1960, *C. Ochoa S-6* (= *PI-365349*), 2n=24 (OCH, US, plants grown at Sturgeon Bay, Wis., U.S.A.).

Province Canta: Culluay [near Canta], 3900 m alt., on open rocky slopes, plants low, rosette-like to rather tall (exposure variations), flowers purple, tubers round, 7 March 1958, *D.S. Correll, E.E. Smith and R. Ferreyra P297* (F, LL, UC). Near Culluay, 3600-3700 m alt., between Canta and Cordillera de La Viuda, on rocky slopes near *puna* grassland, flowers purple, 7 March 1958, *R. Ferreyra, E.E. Smith* and *D.S. Correll 12961* (OCH, USM). Near Huaros, 3700 m alt., along the banks of the stream Tarcora, n.v. *Papa Abuelo*, 11 March 1977, *C. Ochoa 11306*, 2n=24 (OCH, US).

Province Huarochirí: Rio Blanco, 3000-3500 m alt., open hillside. April 15-17, 1929, *E.P. Killip and A.C. Smith 21723* (NY, US). At km 110, 3550 m alt., on and about ledges above Rio Blanco, flowers deep lavender, fruits broadly ovoid, 2.5 cm in dia., tubers large, ellipsoid, flat, 3.5 cm long, March 15, 1960, *D.S. Correll and E.E. Smith P722* (F, LL, NY, US). Km 120 below Casapalca, 3750 m alt., in brush among boulders, flowers large, purple, rotate-pentagonal, March 15, 1960, *D.S. Correll and E.E. Smith P724* sheets 1, 2 (LL). Near Quishuarpujio, 3600 m alt., between Pacomanta and Huarochirí, entering by the route Lima-Huarochirí, plants very vigorous, growing in the shade of shrubby thickets and enormous rocks, 22 April 1960, C. *Ochoa 2305 and 2306* (OCH). Ahuacha, 3900 m, along the route Lima-Huarochirí, in rocky areas, associated with thickets of *Eupatorium, Barnadesia* and *Urtica*, 22 April 1960, *C. Ochoa 2307* (OCH). Río Blanco, 3300-3400 m alt., along the Lima-Oroya highway, prairie, flowers purple, 9 March 1953, *R. Ferreyra 8940* (LL, USM), *8950* (USM). Río Blanco, 3500-3550 m alt., between San Mateo and Casapalca, in rocky soil, foothills of a mountain, flowers purple, 25 March 1950, *R. Ferreyra 6985* (LL, USM). Near Chicla, 3650 m alt., heading up from Río Blanco to Chicla, among large rocks and stones, associated with *S. bukasovii* f. *multidissectum*, 1 April 1953, *C. Ochoa, 2055 p.p.* (GH, US), and *2056* (OCH). Between Chicla and Río Blanco, central highway, 8 March 1967, *J. Soukup 3741* (OCH). Highlands near Huarochirí, 3500 m alt., April 1972, *C. Ochoa and P. López Camarena 3665* (OCH, plants grown from tubers at the Universidad Nacional Agraria La Molina, Lima). Along the route Pacomanta-Huarochirí, 3600 m alt., April 1972, *C. Ochoa and P. López Camarena 3666* (OCH, from a plant grown from tubers at the Granja K'ayra, near Cusco in 1973). Near Matarachi, 3650 m alt., before Escomarca, along the route Lima-Huarochirí, 15 April 1974, *C. Ochoa 5213* (OCH). Matarachi, 3650 m alt., along the route Lima-Huarochirí, 15 April 1974, *C. Ochoa 5217* (OCH). Near

Pachacosa, 3800 m alt., along the route Lima-Huarochirí, growing near *S. huarochiriense* and *S. acaule*, 20 March 1975, *C. Ochoa 7421* (OCH). Near San Mateo, 3400 m alt., along the borders of the Lima-La Oroya road, March 1975, *C. Ochoa 7432* (OCH). Heading up from Matucana toward San Mateo, 3400 m alt., on steep stony hillsides, March 1975, *C. Ochoa 7434* (OCH). Vicinity of Chicla, 3800 m alt., near the Lima-La Oroya railroad line, in stony soil in a rocky area, March 1975, *C. Ochoa 7436* (OCH). *Punas* between Pacomanta and Huarochirí, 3800 m alt., among large rocks, 21 March 1977, *C. Ochoa 11321* (OCH). Vicinity of Huarochirí, 3750-3850 m alt., along the route Lima-Huarochirí, in *puna,* 21 March 1977, *C. Ochoa 11330* (CIP, MOL, NY, OCH), *11332* (CIP, F, OCH, US). *Puna* between Pacomanta and Huarochirí, 3800 m alt., along the route Lima-Huarochirí, via Sisicaya, among large rocks, 21 March 1977, *C. Ochoa 11333*, 2n=24 (CIP, F, OCH, US). Near Chicla, 3700 m alt., among large rocks, 22 January 1979, *C. Ochoa 13106*, 2n=24 (CIP, MOL, OCH). Between the *punas* of Millioc and Marcapomacocha, 4200 m alt., near *S. bukasovii* f. *multidissectum, S. acaule* and *Stipa ichu*, 16 February 1979, *C. Ochoa 13181* (CIP, OCH). Near and above the Macachaca River, 3425 m alt., between Caranaco and Huancamachay (vía Marcapomacocha), 11 April 1979, *C. Ochoa 13275*, 2n=24 (CIP, MOL, OCH). Bellavista, 4000 m alt., right bank of the Rimac River, between Chicla and Casapalca, on talus slopes along the Lima-La Oroya road, in rocky areas, with *Cajophora* sp., February 1982, *C. Ochoa 14516*, 2n=24 (CIP, F, OCH, US). Pacomanta, 3800 m alt., near the Lima-Huarochirí highway, in and among shrubby thickets and large rocks, flowers large blue-violet or purple, March 1982, *C. Ochoa 14618* (CIP, F, NY, OCH, US). Tupicocha, 3200 m alt., along the route Cocachacra-San Damián, 21-24 April 1982, *C. Ochoa and A. Salas 14721*, 2n=27 (CIP, OCH). Vista Alegre, 3500 m alt., between Collata and San Mateo, along the Lima-La Oroya highway, on rocky talus slopes, associated with large colonies of *Urtica* sp., 7 May 1982, *C. Ochoa* and *A. Salas 14743*, 2n=24 (CIP, MOL, OCH, US), *14744*, 2n=24 (OCH), and *14745*, 2n=24(CIP, OCH). Near the Casapalca bridge, 3950 m alt., along the route Lima-La Oroya, in *puna* grassland with *Stipa ichu*, 14 April 1983, *C. Ochoa 15150*, 2n=24 (CIP, OCH, plants grown from seed at Huancayo). Near Chicla, 3700 m alt., on rocky talus slopes of the Lima-La Oroya road, plants rosette-forming, corolla blue-violet, 3.5-4.0 cm in dia., 10 January 1984, *C. Ochoa 15298*, 2n=24 (CIP, OCH). At km 100 near Infiernillo, along the highway route Lima-La Oroya, 4 January-10 February 1984, *C. Ochoa 15299*, 2n=24 (CIP, OCH, plants grown at Huancayo). Near Huarochirí, 26 November 1960, *C. Ochoa S-7* (= *PI-365350*), 2n=24 (US, plants grown at Sturgeon Bay, Wis., U.S.A., Summer 1987). Near Huarochirí, in *puna*, 14 February 1961, *C. Ochoa S-8* (= *PI-365304*), 2n=24

(US, from living plants grown at Sturgeon Bay, Wis., U.S.A., Summer 1987). Heading up the highway San Mateo-Ticlio. [Without date], *J. Soukup s.n.* (OCH, USM-10764).

Province Yauyos: Huancracha, 2505 m alt., near Tupe, n.v. *Aya Papa*, 15 January 1952, *E. Cerrate 1170* (OCH, USM). Yuncalara, 3200 m alt., near Laraos, 15 March 1965, *C. Ochoa 2580* (OCH). Challqui, 300 m alt., near Piños, 15 March 1965, *C. Ochoa 2581* (OCH). Quililuvia, 3000 m alt., near Challqui and Piños, 15 March 1965, *C. Ochoa 2582* (OCH). Anquitupe, 3000 m alt., near Piños and Quililuvia, 15 March 1965, *C. Ochoa 2583* (OCH). Pacaya, 3200 m alt., near Vitis, 15 March 1965, *C. Ochoa 2586* (OCH). Tontinia, 3200 m alt., near Miraflores in Vitis, 15 March 1965, *C. Ochoa 2587* (OCH). Between Piños and Miraflores, District Miraflores, 3200 m alt., 15 March 1965, *C. Ochoa 2588* (OCH). Ampi, 3200 m alt., near Huancaya, 15-18 March 1965, *C. Ochoa 2589* (OCH). San Juan, 2700 m alt., near Tin Tin, 15-18 March 1965, *C. Ochoa 2590* (OCH). Yuncalla, 3250 m alt., near Aquicha, 15-20 March 1965, *C. Ochoa 2596* (OCH). Chaquichujro, 3200 m alt., near Aquicha, 15-20 March 1965, *C. Ochoa 2597* (OCH). Acpujro, 3300 m alt., near Huantán, 15-20 March 1965, *C. Ochoa 2598* (OCH). Lanchataya, 3600 m alt., near Huantán, 15-20 March 1965, *C. Ochoa 2599* (OCH). Chapaca, 3500 m alt., above Yauyos, 15-20 March 1965, *C. Ochoa 2601* (OCH). Chujpalla, 3400 m alt., near Pampas, along the route to Yauyos, flowers whitish, 15-20 March 1965, *C. Ochoa 2603* (OCH). Muylara, 3500 m alt., near Huantán, 15-18 March 1965, *C. Ochoa 2604* (OCH). Sapce, 2800 m alt., near Pampas, 15-18 March 1965, *C. Ochoa 2606* (OCH). Cerro Shashaco, 3400 m alt., near Yauyos, March 1973, *C. Ochoa 3659* (OCH, from a plant originally transplanted and grown at the Universidad Nacional Agraria La Molina, Lima). Between Peroyda and the right bank of the Pucayacu River, 3340 m alt., heading up by the bank of the river to Peroyda, on rocky hillsides, March 1973, *C. Ochoa 3891* (OCH, type collection of *S. hapalosum* Ochoa). Ijata, 3600 m alt., near Cacra, fruits round, 2.5 cm dia., 21 April 1979, *C. Ochoa 13279*, 2n=24 (CIP, OCH, from plants grown at CIP-Huancayo), *13280*, 2n=24 (CIP, OCH, US, from plants grown at Huancayo), and *13281*, 2n=24 (OCH). District Miraflores, place Achucura, ca. 3100-3200 m alt., along the right bank of the Miraflores River, in shrubby thickets and cactus, 23 January 1981, *D. Baumann s.n.* (MOL, OCH, US, USM). District Alis, Cerro Sunca (Huaclacancha), ca. 3900 m alt., along the right bank of the Alis River, 28 April 1981, *D. Baumann s.n.* (OCH, MOL, USM). Lower slopes of Cerro Uman Huaro, 3600 m alt., near Tomás, along the banks of the Alis River and north of Laraos, 5-7 April 1982, *C. Ochoa and A. Salas 14651* (OCH). On the upper levels of Huaclacancha, 3900 m alt., near Cerro Sunca, District Alis, north of Laraos, 5-

7 April 1982, *C. Ochoa* and *A. Salas 14654*, 2n=24 (CIP, MOL, OCH, US). Lower slopes of Uchucu Cañón, 3600 m alt., near Alis, north of Laraos, 5-7 April 1982, *C. Ochoa* and *A. Salas 14656*, 2n=24 (CIP, MOL, OCH). Near the Miraflores River, 3300 m alt., heading up from Tingo towards Miraflores, in a quebrada in the shade of *Schinus molle*, berries ovoid, green, with vertical stripes, dark purple, 5-7 April 1982, *C. Ochoa and A. Salas 14657*, 2n=24 (CIP, MOL, OCH) and *14704*, 2n=24 (CIP, OCH). Quisicaya, 3400 m alt., District Huampará, along the route from Pilas via Tres Cruces to Quinocay, on a gravelly hillside, scarce, May 1982, *C. Ochoa 14709* (OCH). Near Miraflores, heading up the Quebrada de Tingo, 3350 m alt., associated with *Bidens, Lupinus, Verbena* and *S. nigrum* in the shade of trees of *Buddleja*, 15 April 1988, *C. Ochoa s.n.* (CIP, OCH, US). Qebrada de Anchucara, 3250 m alt., between Icaya and Miraflores, near the branch of the road Tingo-Miraflores, 15 April 1988, *C. Ochoa s.n.* (CIP, GH, OCH, US). Near Icaya, 3200 m alt., on steep hillsides of the mountain between Tingo and Achucara, 15 April 1988, *C. Ochoa s.n.* (CIP, OCH).

Department Moquegua

Province Mariscal Nieto: Carumas, 3100 m alt., rainy-green formation, tuber-bearing, flowers violet, February 21-March 6, 1925, *A. Weberbauer 7257* (F).

Department Pasco

Province Pasco: Yanamacctachay [Yanamachay], 3650 m alt., Cerro de Pasco [today Department Pasco], in *puna*, among rocks at the margins of cultivated areas, 7 March 1927, *S. Juzepczuk 10605* (lectotype here designated LE, isotype OCH, plants grown from seed near Leningrad, U.S.S.R.); also, Yanamactachay, Cerro de Pasco, Central Peru, Department of Junín, *S. Juzepczuk*, grown from seed at Paulowsk, Leningrad (LE 563; OCH-photo). Condorhuachanan, 4000 m alt. in Hacienda Andachaca and Cerro de Pasco, *puna*, among large rocks with *Stipa ichu* and *Solanum acaule*, January 1947, *C. Ochoa 23* (CPC, GH, OCH). Milpo, 3700 m alt., canyon between Cerro de Pasco and La Quinua, corolla large, deep blue, January 1947, *C. Ochoa 31* (CPC, GH, OCH, US). Yanamachay, 3650 m alt., canyon Cerro de Pasco-La Quinua, flowers large, blue, berries ovoid, tubers 3-4 cm long, white or light brown, 1 April 1948, *C. Ochoa 320* (OCH, topotype of *S. bukasovii*). La Quinua, 3500 m alt., canyon between Cerro de Pasco and La Quinua, near Yanamachay, the type locality of *S. bukasovii*, 1 April 1948, *C. Ochoa 322* (OCH, US). La Quinua, 3500 m alt., in the canyon Cerro de Pasco-La Quinua, just 1.5 km from Yanamachay, the type locality of *S. bukasovii*, with tufts of *Stipa ichu*, in rocky or sandy-clay soil, plants small, abundant, 6 April 1948, *C. Ochoa 473* (OCH). About 4 km from Cerro de Pasco, going down the narrow canyon toward La Quinua, 4100 m alt., on rocky levels with *Stipa ichu*, plants small, rosette-forming, flowers blue, large, 17 April 1948, *C. Ochoa 480* (GH, OCH). About 10 km from Cerro de Pasco, going down the narrow canyon toward La Quinua, 3600 m alt., just a little before Yanamachay, the type locality of *S. bukasovii*, plants rosette-forming, very pilose along the stems, petioles and rachis, March 1951, *C. Ochoa 1028* (OCH). Rocky flanks of Yanamachay, 3650 m alt., going down the canyon of Cerro de Pasco towards La Quinua, among abundant tufts of *Stipa ichu*, 8 May 1961, *C. Ochoa 2379* (OCH, topotype of *S. bukasovii*). Cerro Huishca, 3800 m alt., about 15 km before Paucartambo along the edges of the road Carhuamayo-Paucartambo, 21 March 1968, *C. Ochoa 2678* (OCH). Near La Quinua, 3550 m alt., between Yanamachay and La Quinua, in sandy-rocky soils, n.v. *Cuenca Papa*, 4 March 1977, *C. Ochoa 11293, 11293-1* and *11293-2* (OCH). Camichivo, 3900 m alt., about 6 km from Cerro de Pasco, going down the canyon Cerro de Pasco-La Quinua, on rocky talus slopes, 4 March 1977, *C. Ochoa 11295* (OCH) and *11295-F1* (OCH, plants with white flowers and blue and violet flowers that segregated from seeds). Chaupimarca, 3900 m alt., between kms 9-10, going down the Canyon of Cerro de Pasco toward La Quinua and Salccachupan, flowers large blue-violet, 6 March 1977, *C. Ochoa 11300* (CIP, F, NY, OCH). Near Guanuni, 4000 m alt., above La Victoria, along the route Carhuamayo- Paucartambo, in grassland of *Stipa ichu*, 18 January 1978, C. *Ochoa 11859*, 2n=24 (CIP, NY, OCH, US), *11861*, 2n=24 (CIP, MOL, NY, OCH, US), and *11862*, 2n=24 (CIP, F, GH, MOL, NY, OCH, US). Jipispin, 3900 m alt., near Pampania, District Tusi, 28 January 1978, C. *Ochoa 11864*, 2n=24 (CIP, F, GH, MOL, NY, OCH, US), and *11864-A*, 2n=24 (CIP, F, NY, OCH, US). Near La Quinua, 3500 m alt., heading down towards Salccachupán, in the shade of *Polylepis* trees with an understory of *Stipa ichu*, 19 April 1980, *C. Ochoa 13854*, 2n=24 (CIP, MOL, F, OCH, US), and *13855*, 2n=24 (CIP, MOL, NY, OCH, US). La Quinua, 3550 m alt., among trees of *Polylepis*, 19 April 1980, *C. Ochoa 13856* (CIP, OCH). Near Yanamachay, 3650 m alt., going down the Canyon of Cerro de Pasco toward La Quinua, between Cerro de Pasco and La Quinua, 19 April 1980, C. *Ochoa 13857*, 2n=24 (CIP, OCH). Carmen Chico, 3800 m alt., near Yanamachay, going down the Canyon of Cerro de Pasco toward La Quinua, with *Stipa ichu*, 19 April 1980, C. *Ochoa 13858*, 2n=24 (CIP, F, OCH, US), and *13859*, 2n=24 (CIP, F, MOL, NY, OCH, US). San Roque, 4200 m alt., near Cerro de Pasco, at the beginning of the descent of the narrow canyon toward La Quinua, 19 April 1980, *C. Ochoa 13860*, 2n=24 (CIP, F, MOL, NY, OCH, US), and *13861*, 2n=24 (CIP, MOL, NY, OCH, US). Llocclla, 3850 m alt., going down the canyon of Cerro de Pasco to La Quinua, with *Stipa, Tropaeolum, Plantgo*, 19 April 1980, *C. Ochoa 13862* and *13863*, 2n=24 (both in CIP, F, MOL, NY, OCH, US). Paso de Capilla, 4300 m alt., along the route Carhuamayo-Paucartambo, 20 April 1980, *C. Ochoa 13866* (CIP, F, GH, MOL, NY, OCH, US), and *13867*, 2n=24 (CIP, MOL, OCH, US). 2 km before La Victoria, along the route Carhuamayo-Paucartambo, 3600 m alt., in grassland, 1 May 1983, *C. Ochoa* and *A. Salas 15194*, 2n=24 (CIP, OCH), *15196*, 2n=24 (CIP, OCH, US), *15197* (CIP, OCH), *15198* (CIP, OCH, US), *15200*, 2n=24 (CIP, F, MOL, NY, OCH), *15201*, 2n=24 (OCH, US), *15201-A* (CIP, OCH), *15202*, 2n=24 (CIP, OCH, US), and *15203*, 2n=24 (CIP, OCH, US). Yanamachay, 3700 m alt., Canyon of Cerro de Pasco to La Quinua, between tufts of *Stipa ichu*, near the Black Cave of Yanamachay, abundant, leaves moderately divided with few interjected leaflets and leaflets on short petiolules, growing with a plant of *S. bukasovii* f. *multidissectum*, 30 January 1984, *C. Ochoa 15304*, 2n=24 (CIP, OCH, topotypes of *S. bukasovii*), and *15304A*, 2n=24 (OCH, type locality of *S. bukasovii*).

Department Puno

Province Carabaya: Chuñuhuani, 4100 m alt., above Juro Juro, on the slopes of a mountain among large rocks with *Stipa ichu* and *Ranunculus argemonifolius*, 16 February 1983, *C. Ochoa 15064*, 2n=24 (CIP, OCH). On the lower slopes of Japu Uma, 4000 m alt., between Juro Juro and Macusani, among large rocks, with *Stipa ichu, Saracha* sp. and *S. acaule*, plants slightly rosette-forming, flowers deep violet, 18 February 1983, *C. Ochoa 15076* (CIP, MOL, OCH, US) and *15077*, 2n=24 (CIP, MOL, OCH, US).

Province Chucuito: Muñani, 4150 m alt., in rocky areas; corolla varying from blue to deep purple, March 1949, *C. Vargas C. 8270* (CUZ, LL).

Province Melgar: Between Ccaccachupa and Jaillani, 4200 m alt., near La Raya Pass, heading up from Santa Rosa toward La Raya, on rocky hillsides and within old stone enclosures (corrales), growing with *Stipa ichu*, plants compact, rosette-forming, flowers deep purple, growing with *S. bukasovii* f. *multidissectum*, which has white flowers (= *OCH 13523*), 24 January 1980, *C. Ochoa 13526*, 2n=24 and *13527* (OCH). About 1 km below the farm of the Camélidos Americanos of La Raya, 4000 m alt., in grassland, 24 January 1980, *C. Ochoa 13536*, 2n=24 (CIP, MOL, OCH, plants grown from seed at Huancayo). Near km 102 of the road Cusco-Puno, 4100 m alt., between La Raya Pass and Santa Rosa, among large rocks associated with *Stipa ichu*, 11 March 1984, *C. Ochoa 15623*, 2n=24 (CIP, MOL, NY, OCH, US), *15624*, 2n=24 (CIP, OCH), and *15625*, 2n=24 (CIP, MOL, OCH).

Province Puno: Ilpa, 3800 m alt., amongst heaps of stones at edge of potato fields, 23 April 1939, *E.K. Balls and J.G. Hawkes 6620* (CPC 3 sheets; UC, type collection of *S. punoense*, plants grown from seed at Cambridge, England). Near Puno hills, behind Granja Taller Escolar de Puno, 3800 m alt. April 25, 1939; *E.K. Balls and J.G. Hawkes* 6667 (CPC, K, LL-photo, type collection of *S. soukupii*). Hills behind the Granja Taller Escolar de Puno, Puno, 3825 m. April 25, 1939; *E.K. Balls and J.G. Hawkes 6668* (CPC, LL-photo, paratype). Between cerro Llahuini and cerro Cuaquisa [Prov. Puno], 3800-4100 m alt., *puna*, 6 March 1948, *E. Zúñiga 044* (LL, USM). Thirteen km from Puno toward Tingo Palca, 4300 m alt., 10 March 1953, *Peterson, Hjerting and Reche 1078* (OCH). Cabrasillo, 3820 m alt., near Puno, on talus slopes along the Puno-Juliaca road, 16 March 1953, *C. Ochoa 2032* (OCH). Ccaccapunco, 3950 m alt., between Vilque and Mañazo, near km 28, on rocky talus slopes of the Puno-Arequipa road, 4 May 1962, *C. Ochoa 2430* (OCH). 10 km from Puno along road to Juliaca, 3800 m alt., plants low, bushy, flowers purple, rotate to rotate-stellate, plants common in rubble and among boulders, 22 February 1958, *D.S. Correll and E.E. Smith P196* (LL, sheet 2, UC). 10 km from Puno, on road to Juliaca, 3800 m alt., flowers purple, rotate, 22 February 1958, *D.S. Correll* and *E.E. Smith P197* (K, LL, UC, USM), *P198* (F, LL), *P199, and P200* (LL). Camacani, 4100 m, 27 km SE of Puno, among boulders on mountain slope, plants slender and simple to robust and much-branched, flowers purple, up to 4.5 cm in diam. (some double), 23 February 1958, *D.S. Correll and E.E. Smith P215* (GH, K, LL, MO, NY US. UC, USM), and *P215* sheet 2 (LL). Prepuna, 3920 m alt., on stone piles, April 1959, *C. Vargas C. 12544* (WIS). Open roadside, rocky soil, 3800 m alt., with *S. soukupii, Senecio, Tagetes, Capsella, Brassica, Verbena, Lupinus, Cerastium,* and non-tuberous *Solanum* sp., 27 March 1963, *D. & V. Ugent 4526* sheet 3 (OCH), *4528* sheets 1, 2, 3 (WIS), *4532* sheets 1, 2 (WIS), *4534* sheet 1 (US), and *4548* sheet 3 (WIS). Chucuito, 3900-4000 m alt., 31 km from Desaguadero to Puno, on mountain rock face and scree just below, plant near hill top like *canasense*, those below resemble *S. oplocense/sparsipilum*, flowers blue-violet, leaf varies in width of leaflets and decurrency, possibly all same thing, 5 April 1971, *J.G. Hawkes, J.P. Hjerting, P.J. Cribb and Z. Huamán 5057 p.p.* plant-2 (CIP). Herrerapata, 3950 m, farm Huerta, NE of Puno, flowers blue-violet, to 4.5 cm dia., leaflets narrow, pubescent, with interjecteds, berries with striped pigmentation or with stripes and spots, somewhat elongated, 4 April 1971, *J.G. Hawkes, J.P. Hjerting, P.J. Cribb and Z. Huamán 5063* (CIP); *5063A* and *5063B*, 2n=24 (CIP, from plants grown at Huancayo). Huerta, 6 km from Puno toward Juliaca, on path, by lake side, 3900 m, flowers blue pale, 4 April 1971, *J.G. Hawkes,* *J.P. Hjerting, P.J. Cribb and Z. Huamán 5064A* (= *PI-473346*) and *5064C*, 2n=24 (= *PI-442696*, USA) (CIP, plants grown at Huancayo and Sturgeon Bay, WIS., USA). 5 km from Puno on road to Juliaca, 3950 m, growing in and under walls and among scree, very common, berries very variable, from white to pigmented to spotted, 6 April 1971, *J.P. Hjerting, P.J. Cribb and Z. Huamán 5072*, 2n=24 (CIP). 10 km on old road from Puno to Juliaca, 4000 m, in walls and among rocks, 7 April 1971, *J.G. Hawkes, J.P. Hjerting, P.J. Cribb and Z. Huamán 5074*, 2n=24 (CIP, OCH). Sillustani, 3900 m, below chullpas on scree and in loose soil, 7 April 1971, *J.G. Hawkes, J.P. Hjerting, P.J. Cribb and Z. Huamán 5075a* (CIP). Ilpa, 1 km off asphalt road from Puno to Juliaca, 3900 m, type locality of *S. punoense*, 7 April 1971, *J.G. Hawkes, J.P. Hjerting, P.J. Cribb and Z. Huamán 5076*, 2n=24 (CIP, OCH, from plants grown at Huancayo; US, from plant grown at Sturgeon Bay, WIS., USA). Chokmoke, 3880 m alt., near Chingone, District Capachica, n.v. *Ck'ita Papa* (= Papa Silvestre) or *Añas Papa* (= Papa de Zorrino), May 1974, *C. Ochoa 5430* (OCH). Ckusilluni, 3780 m alt., about 7 km from Puno, along the route Puno-Illpa, 25 January 1980, *C. Ochoa 13542*, 2n=24 (CIP, MOL, OCH). Cerro Pitiquillani, 3750-3850 m alt., behind the main house of Granja Salcedo, 26 January 1980, *C. Ochoa 13543*, 2n=24 (CIP, MOL, OCH, topotype of *S. soukupii*). Cuturati, 3820 m alt., between Puno and Chucuito, among large rocks and stones growing with *Stipa ichu* and *S. acaule*, 27 January 1980, *C. Ochoa 13546 p.p.* (OCH, only a single plant). Cuturati Alto, 3850-3870 m alt., among rocks, 1 km above Cuturati, east of the road between Puno and Chucuito, 27 January 1980, *C. Ochoa 13549* (CIP, OCH), and *13551* (OCH). Vicinity of the ruins of Sillustani, 3850 m alt., among stones, 26 January 1980, *C. Ochoa 13558*, 2n=24 (CIP, OCH), *13559*, 2n=24 (CIP, OCH), and *13560* (OCH). Illpa, 3900 m alt., near the main house of the Hacienda, among stone piles growing with shrubs of *Chuquiraga* and tufts of *Stipa ichu*, leaflets of variable shape and width, flowers purple-violet, fruits ovoid, marked with white dots and vertical purple stripes, 9 March 1984, *C. Ochoa 15612*, 2n=24 (CIP, F, NY, OCH, US, topotype of *S. punoense*). Ckusilluni, 3900 m alt., near km 7 of the Puno-Juliaca road, within an enclosure of pine trees, in loose black soil, flowers purple, 9 March 1984, *C. Ochoa 15616*, 2n=24 (GH, CIP, OCH, USM). Aproximately 1 km from the the main house of Granja, 3800 m alt., in rock crevices, plants up to 40 cm, stem winged, flowers purple, 9 March 1984, *C. Ochoa 15618*, 2n=24 (OCH, USM).

Natural Hybrids of *Solanum bukasovii* Juz.

In nature, there occurs a certain amount of gene flow between the sympatrically distributed species of this series and Megistacroloba. Currently, the following two putative hybrids of *S. bukasovii* are recognized for southern Peru:

Solanum bukasovii × *S. megistacrolobum*

Plant small and vigorous. Stem thick, flexible, with shortened internodes at base. Leaves little divided, with 3-4(-5) pairs of elliptic-lanceolate or narrowly elliptic-lanceolate and sessile leaflets, and 0-2 pairs of interjected leaflets. Lateral leaflets of the first and second upper pairs decurrent or broadly decurrent about the rachis. Floral peduncle always axillary and extremely slender, sustaining 1-3 flowers. Pedicels articulated well above the midpoint. Corolla pale violet, narrowly rotate-pentagonal, 2.5-3.0 cm in dia. Tubers ovoid or long compressed, with purple periderm. 2n=24.

Specimens Examined

Department Arequipa

Province Cailloma: Qebrada de Utupara, 4220 m alt., above the *punas* of Chacramayo, about 4 km west of Pulpera, at the Chivay-Shibayo road detour to Pulpera, growing near *S. megistacrolobum* and *S. acaule*, in grasslands of *Stipa ichu*, 29 March 1974, C. *Ochoa 5094* (OCH). Qebrada de Utupara, about 3 km west of Pulpera, 3780 m alt., very rare, 6 May 1981, C. *Ochoa 14270* (OCH), and *14271*, 2n=24 (CIP, OCH).

Solanum bukasovii × *S. raphanifolium*

The hybrid character of plants of this combination is well expressed in the intermediate shapes of the leaves and leaflets. Moreover, the terminal leaflet of the hybrid is larger than the laterals, and the first upper pair is strongly decurrent about the rachis. Features of this hybrid that are similar to *S. raphanifolium* include the very slender peduncle, the position of the pedicel articulation and the rotate-pentagonal corolla, while the characters that are most similar to *S. bukasovii* include the erect, vigorous habit and the degree of leaf dissection.

Specimens Examined

Department Cusco

Province Cusco: Rock quarry near Grupo Arqueológico, 4.5 km north of Cusco, along the Cusco-Pisac road and 0.64 km east at the turn-off to the ruins (near center of the road between the ruins of Sacsahuamán and Tambo Machay, 3600 m alt., 6 March 1963, *D. and V. Ugent 4116* sheets 1 and 2 (WIS), *4117* sheets 1 and 2 (WIS), *4120* sheets 1, 2, 3, 4 and 5 (WIS), *4118* sheets 1 and 2 (OCH), *4119* (OCH), *4173* sheets 1 and 2 (WIS), *4174* and *4175* (WIS).

Breeding Potential

The results of crosses of *S. bukasovii* with diploid species (2n=24) of EBN=1 and 2, tetraploid species (2n=48) of EBN=2 and 4, and hexaploid species (2n=72) of EBN=4 are given in Table 64, while the field materials used for these experiments are shown in Table 65.

No fertile seeds were obtained in reciprocal crosses involving *S. bukasovii* (2n=24 and EBN=2) and *S. raquialatum*, *S. dolichocremastrum*, *S. hypacrarthrum*, *S. chancayense* and *S. immite*, all diploids with EBN=1. Crosses with *S. lignicaule*, on the other hand, another diploid species having an EBN value of 1, were highly successful, but only when *S. lignicaule* was used as the staminate parent. Similarly, unilateral crosses of *S. bukasovii* with another diploid species having an EBN value of 1, *S. humectophilum*, yielded an even higher average number of seeds per berry (342), despite the fact that this species belongs to an entirely different series and has little or no affinity to *S. bukasovii*. Reciprocal crosses of *S. bukasovii* with *S. jalcae* also ended in failure, even though both species are of the same chromosome number and have identical EBN values. This can probably be explained by the fact that the series to which *S. jalcae* belongs, Ingaefolia, is quite distant, evolutionarily speaking, from that of Tuberosa. Other interseries crosses between *S. bukasovii* and diploid species of the same EBN value were successful, including experiments involving *S. chomatophilum*, *S. laxissimum*, *S. limbaniense*, *S. rhombilanceolatum* and *S. santolallae* of Series Conicibaccata, and *S. megistacrolobum* var. *toralapanum*, *S. raphanifolium* and *S. sogarandinum* of Series Megistacroloba.

In reciprocal crosses between *S. bukasovii* and other diploid species of Series Tuberosa having similar EBN value, the greatest amount of compatiblity was found with species that had leaves and leaflets that resembled those of *S. bukasovii*, as, for example, in the case of *S. ambosinum*, *S. coelestispetalum*, *S. incasicum*, *S. orophilum* and *S. sarasarae*. The crosses that were attempted between these species and *S. bukasovii* yielded fruits containing 117 to 375 seeds per berry on the average. Similar crosses involving *S. leptophyes*, a species reputed to be very close to *S. bukasovii*, also yielded a high average number of seeds per berry with *S. bukasovii* (117) and its forma *multidissectum* (186). However, reciprocal crosses with *S. amayanum*, which is also a very close relative of *S. bukasovii*, succeeded only when this species was used as the staminate parent, yielding, in this instance, over 100 seeds per berry on the average.

The results of reciprocal crosses involving *S. bukasovii* and non-related diploid species of the same EBN value, such as *S. huarochiriense*, *S. marinasense*, and *S. tapojense*, were surprisingly successful, as were crosses involving the diploid cultivars of *S. goniocalyx*, *S. phureja* and *S. stenotomum* (the latter used only in unilateral crosses). All yielded fairly high average numbers of seeds per berry. Moreover, moderate success (40-80 seeds per berry) was obtained in crosses involving *S. bukasovii* and *S. huancabambense*, *S. medians*, *S. multiinterruptum*, *S. sawyeri*, *S. sparsipilum*, *S. tacnaense* and *S. aymaraesense* (the latter used unilaterally). A further surprise was in receiving a very high number of seeds per berry (233) in the Unilateral cross of *S. bukasovii* with *S. tarapatanum*. However, the unilateral cross of *S. bukasovii* with *S. ancophilum* was incompatible, yielding only parthenocarpic berries.

Finally, the reciprocal crosses of *S. bukasovii* with plants of Series Acaulia gave mixed results. Thus, when *S. bukasovii* was crossed reciprocally with *S. acaule*, only moderate numbers of seeds per berry (32-50) were obtained, whereas crosses with *S. albicans* gave much fewer seeds per berry (15), and then largely when this species was used as the pistillate parent. In both of these aforementioned cases, the results obtained may be of some interest to the plant breeder as crosses of this nature could lead to the segregation of polyploid individuals in the F_1 generation. Tetraploid individuals resulting from such crosses might be easily hybridized with clones of *S. tuberosum* subsp. *andigena*, thus resulting in new variants of possible interest to the potato grower.

Table 64. Fertility of *Solanum bukasovii* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	INGAEFOLIA	× *S. raquialatum*	10(3)	5(3)	0(0)
24	1	LIGNICAULIA	× *S. lignicaule*	27(35)	18(20)	83(0)
24	1	MEGISTACROLOBA	× *S. dolichocremastrum*	58(44)	32(31)	0(0)
24	1	PIURANA	× *S. humectophilum*	3	3	342

			× *S. hypacrarthrum*	23(14)	16(7)	0(0)
24	1	TUBEROSA	× *S. chancayense*	3(19)	0(15)	0(0)
			× *S. immite*	23(17)	11(13)	0(0)
24	2	CONICIBACCATA	× *S. chomatophilum*	88(86)	54(64)	40(17)
			× *S. laxissimum*	53(26	31(11)	66(126)
			× *S. limbaniense*	8(7)	3(40)	150(29)
			× *S. rhombilanceolatum*	84(39)	52(30)	111(146)
			× *S. santolallae*	4	3	146
24	2	CUNEOALATA	× *S. peloquinianum*	3	2	5
24	2	INGAEFOLIA	× *S. jalcae*	16(12)	11(10)	0(0)
24	2	MEGISTACROLOBA	× *S. megistacrolobum* var. *toralapanum*	22(63)	18(39)	91(18)
			× *S. raphanifolium*	222(160)	151(90)	109(105)
			× *S. sogarandinum*	147(101)	83(71)	77(37)
24	2	PIURANA	× *S. cantense*	7	3	0
			× *S. chiquidenum*	9(4)	4(3)	50(0)
			× *S. chiquidenum* var. *robustum*	16(5)	7(4)	0(0)
24	2	TUBEROSA	× *S. amayanum*	15(4)	8(4)	113(0)
			× *S. ambosinum*	88(44)	66(37)	246(148)
			× *S. ancophilum*	10	5	0
			× *S. aymarasense*	6	4	60
			× *S. bukasovii* f. *multidissectum*	128(118)	104(75)	142(150)
			× *S. coelestispetalum*	120(169)	81(131)	197(226)
			× *S. goniocalyx*	144(45)	94(26)	138(229)
			× *S. huancabambense*	20(23)	10(16)	75(93)
			× *S. huarochiriense*	36(69)	16(54)	134(168)
			× *S. incasicum*	3(10)	2(8)	25(375)
			× *S. leptophyes*	60(88)	54(60)	186(179)
			× *S. marinasense*	157(147)	116(123)	178(145)
			× *S. medians*-3x	6(29)	2(24)	48(25)
			× *S. medians* *var.autumnale*-2x	33(43)	24(39)	37(5)
			× *S. multiinterruptum*	19(32)	15(12)	29(0)
			× *S. orophilum*	235(170)	186(125)	263(130)
			× *S. phureja*	375(98)	310(58)	191(166)
			× *S. sarasarae*	9(11)	9(8)	117(113)
			× *S. sawyeri*	13(5)	12(3)	87(50)
			× *S. sparsipilum*	210(133)	137(89)	82(78)
			× *S. stenotomum*	9	8	183
			× *S. tacnaense*	16(10)	13(8)	88(26)
			× *S. tapojense*	14(14)	9(11)	167(61)

			× *S. tarapatanum*	5	3	233
48	2	ACAULIA	× *S. acaule*	123(61)	97(57)	32(45)
48	4	TUBEROSA	× *S. tuberosum* subsp. *andigena*	36(5)	33(3)	75(167)
72	4	ACAULIA	× *S. albicans*	91(57)	62(49)	2(15)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 65. Collections (OCH) used in *Solanum bukasovii* fertility studies.

ACAULIA

S. acaule 7990, 8611, 9829, 9012, 10111, 10112, 10113, 11602, 11336, 11825, 11829, 11867, 11891, 11895, 11979, 11989, 12069, 12073, 12092, 13109, 13145, 13192, 13870, 14391, 14392, 14402

S. albicans 11842, 12062, 12063, 12067, 12068, 12081A, 12088, 12089, 12090, 12094, 13014, 13238, 14789

CONICIBACCATA

S. chomatophilum 11061, 11276, 11753A, 11764, 11856, 11858, 13198, 13201, 13203, 13205, 13208, 13343, 13844, 13845, 14483, 14786

S. laxissimum 11855, 13188, 13189, 13640, 13706, 13785

S. limbaniense 14290, 14291, 14292

S. rhombilanceolatum 11869, 13112, 14406

S. santolallae 13628

CUNEOALATA

S. peloquinianum 13002, 13230

INGAEFOLIA

S. raquialatum 13947

S. jalcae 13344, 14490

LIGNICAULIA

S. lignicaule 11315, 11316, 11317, 11617, 13584, 13585, 13760

MEGISTACROLOBA

S. dolichocremastrum 12071, 12072, 12074, 13013

S. megistacrolobum var. toralapanum 11914, 11916, 11964, 13544

S. raphanifolium 7573, 7610, 7612, 7619, 8333, 13572, 13575, 13577, 13579, 13604A, 13610, 13610A, 13654, 13695, 13705, 13709, 13721, 13728, 13735, 13755, 13759, 14296, 14318, 14346, 15628

S. sogarandinum 13006, 13324, 13336

PIURANA

S. cantense 14681

S. chiquidenum 13963, 13965A

S. chiquidenum var. robustum 13967

S. humectophilum 13250

S. hypacrarthrum 11308, 13272, 14731

TUBEROSA

S. amayanum 4299

S. ambosinum 11298, 11865, 13850, 15115

S. ancophilum 12099

S. aymarasense 13810

S. bukasovii 5106, 7715, 7726, 7820, 7953, 8083, 8692, 8693, 8845, 9088, 9795, 9802, 9803,9928, 10114, 11058, 11292, 11293, 11295,11300, 11301, 11306, 11330, 11332, 11333, 11337, 11786, 11841,11844, 11851, 11859, 11861, 11864, 11866, 11870, 11871, 11872, 11873, 11874, 11875, 11876, 12043, 13000, 13106, 13113, 13114, 13115, 13116, 13121, 13123, 13124, 13125, 13147, 13163, 13166, 13168, 13169, 13171, 13173, 13174, 13190, 13194, 13195, 13225, 13275, 13279, 13280, 13538, 13542, 13543, 13558, 13559, 13576, 13582, 13599, 13600, 13602, 13622, 13672, 13676, 13678, 13679, 13680, 13684, 13692, 13694, 13696, 13707, 13712, 13712A, 13713, 13714, 13715, 13725, 13742, 13747, 13773, 13789, 13791, 13795, 13796, 13797, 13798, 13799, 13813, 13814, 13814A, 13829, 13830, 13854, 13856, 13857, 13858, 13859, 13860, 13862, 13863, 13866, 13867, 13875, 14275, 14311, 14332, 14333, 14352, 14353, 14355, 14360, 14370, 14372, 14381, 14382, 14383, 14399, 14401, 14404, 14407, 14498, 14646, 14654, 14656, 14743, 15115, 15198, 15202, 15304, 15313, 15623, 15692

S. bukasovii f. multidissectum 11843, 13177, 13182, 13548, 13556, 13581, 13720

S. chancayense 11250, 11765

S. coelestispetalum 7710, 7711, 7728, 13591, 13604, 13605, 13632, 13674,

S. goniocalyx 00001, 3496, 11407, 14502, CIP 701399

S. huancabambense 11619, 11627, 14815

S. huarochiriense 11325, 11329, 11331, 11335, 14525, 15193

S. immite 13346, 14491

S. incasicum 13631

S. leptohpyes 13621, 13671, 13729, 13730, 13731, 13733, 13743

S. marinasense 13567, 13673, 13675, 13689, 13722, 13736, 13737, 13738, 13740, 13748, 13809, 14303, 14316, 14339, 15687

S. medians-2x 11302, 11637, 11638, 12047, 13185, 13240, 13264

S. medians-3x 11261, 11883, 13035, 13036, 13141

S. multiinterruptum 11705, 12055, 14524, 14718

S. orophilum 12077, 12078, 12079, 13003, 13020, 13021, 13023, 13323

S. phureja 5163, 5187, 10199, 10206, 13901, 13903, 14233, 14235, 15071, 15072, 15074, 15130, 15131, 15132, 15133, 15325, 15326, 15332, 15333, JAK 130, 230

S. sarasarae 14919

S. sawyeri 13698

S. sparsipilum 8358, 11822, 11894, 11911, 12035, 13564, 13588, 13644, 13697, 13708, 13718, 13774, 13786, 15522, 15699

S. stenotomum 2762

S. tacnaense 14262, 14265

S. tapojense 11821

S. tarapatanum 7599

S. tuberosum subsp. *andigena* 7845, 8038, 8345,11920,12076,13890,15031

53a. *Solanum bukasovii* Juz. f. *multidissectum* (Hawkes) Ochoa *comb. nov.*

Figs. 261-266; Map 22; Plate XXV.

S. multidissectum Hawkes, Bull. Imp. Bur. Pl. Breed. and Genet., Cambridge 49, 124, Fig. 38. 1944. Type: PERU. Department Cusco, Province Canas, 27 February 1939, *Vargas 11006*.

S. neohawkesii Ochoa, Rev. Argentina Agron. 19:231-234, Figs. 1-2. 1952. Type: PERU. Department Junín, Province Yauli, Casaracra, 3800 m alt., near La Oroya, 23 February 1947, C. *Ochoa 37* (K, OCH, US).

S. canasense var. *neohawkesii* (Ochoa) Corr., Wrightia 2:184. 1961. Type: based on *Ochoa 37*.

S. lobbianum f. *multidissectum* (Hawkes) Corr., Wrightia 2:189. 1961. Type: based on *Vargas 11006*.

S. multidissectum subsp. *neohawkesii* (Ochoa) Hawkes, Scott. Pl. Breed. Sta. Rec., 145. 1963. Type: based on *Ochoa 37*.

While very similar to typical *S. bukasovii*, the forma *multidissectum* of *S. bukasovii* can be distinguished from all other variants of this species largely by its more conspicuous leaf dissection and by its somewhat smaller corolla. The leaves are usually longer and narrower than in the typical species, varying from (9.0-)12.0-22.5(-24.0) cm long by (2.5-)5.0-9.0(-10.0) cm wide, with (5-)7-9 pairs of lateral leaflets and (6-)12-24(-27) pairs of interjected leaflets. Also, the leaflets are usually smaller, and are either elliptic or more narrowly elliptic to elliptic-lanceolate than in the typical species. Other leaflet characteristics include an obtusely to slightly pointed apex and a rounded to cuneate base, the latter attached either obliquely or symmetrically to the 2-5(-10) mm long petiolules. Secondary and even tertiary interjected leaflets are formed frequently along the petiolules of the fourth and fifth upper pairs of leaflets, and these may be aligned either acroscopically, basiscopically or semi-basiscopically. Chromosome Number: 2n=24.

Type: PERU. Department Cusco, Province Canas, vicinity of San Andrés de Checca, 3820 m alt., about old walls, 27 February 1939, C. *Vargas* C. *11006* (K, lectotype, here designated; CPC, isotypes; F, US, paratypes).

Affinities

Solanum bukasovii f. *multidissectum* is related to some extent to the Colombian *S. lobbianum*. Both have strongly divided leaves and are similar in habit and

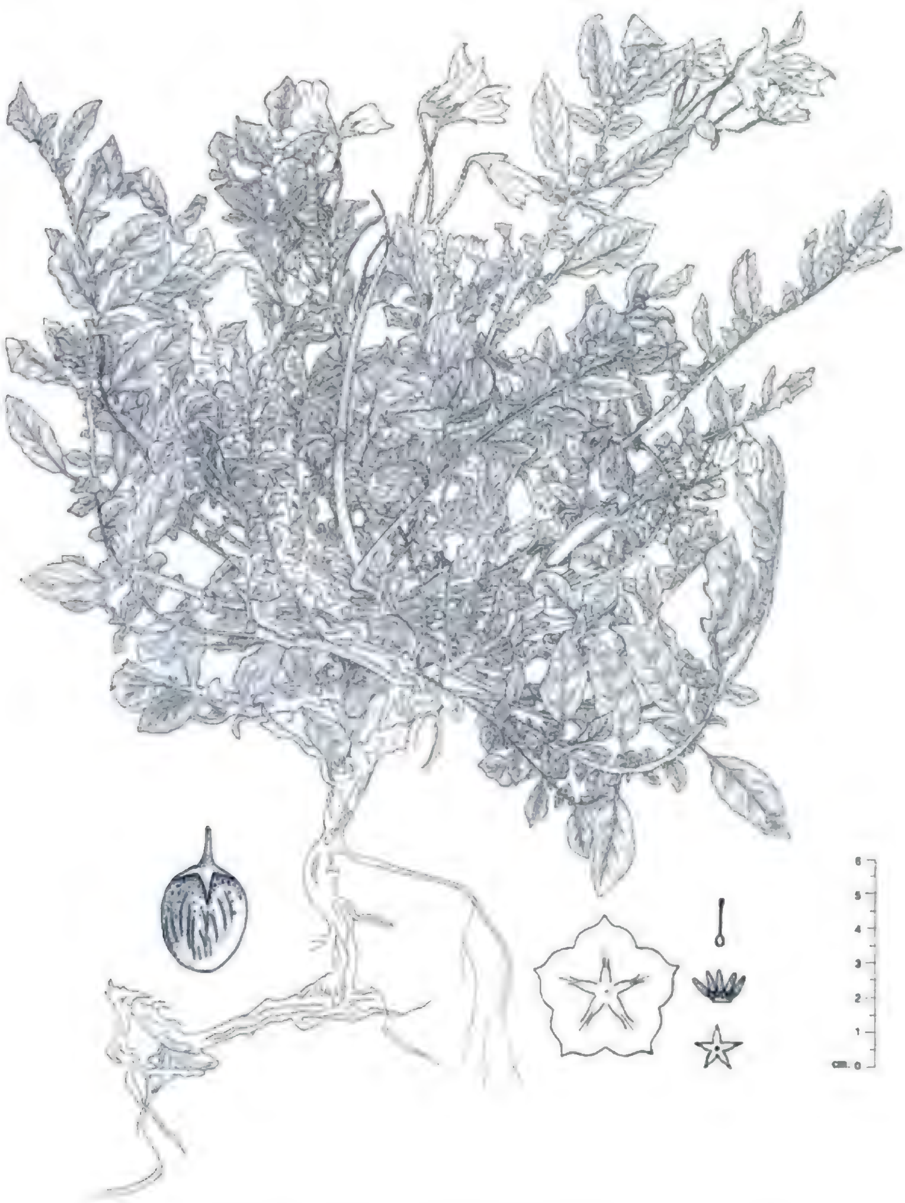


Figure 261. *Solanum bukasovii* f. *multidissectum* (*Ochoa* 37, type of "*S. neohawkesii*").

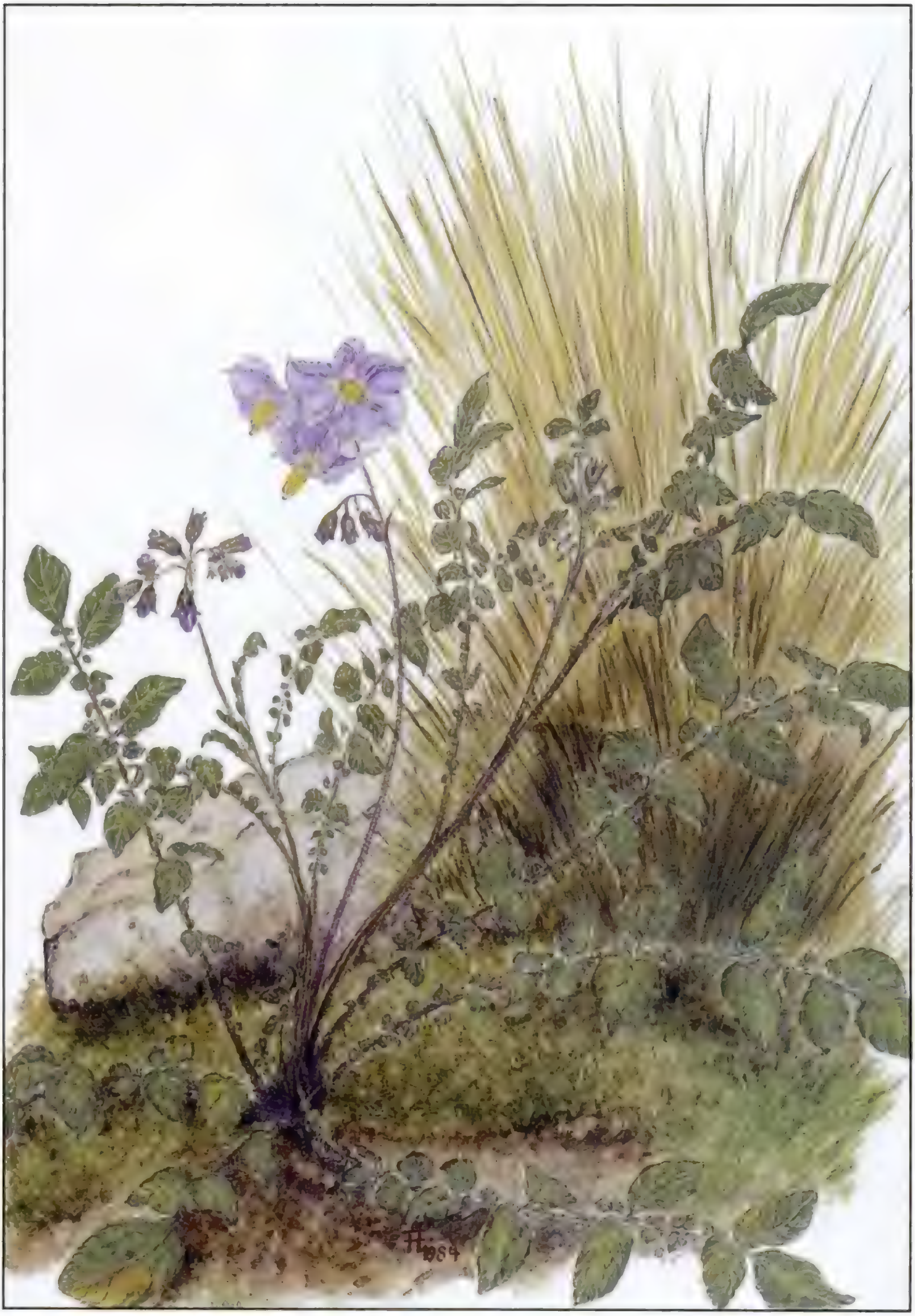


Plate XXV. *Solanum bukasovii* Juz. f. *multidissectum* (Hawkes) Ochoa.

pubescence. These features of f. *multidissectum* were probably the major reasons why Correll (1962, p. 422-424) chose to classify this plant as a form of *S. lobbianum*. As a species, however, *S. lobbianum* can be strongly distinguished from *S. bukasovii* by its very small corolla (1.6-2.0 cm in dia.), very short anthers and style, long-conical fruits (these characteristic of plants belonging to series Conicibaccata) and tetraploid (2n=48) chromosome number.

Habitat and Distribution

As in the case of the typical *S. bukasovii*, the habitats of this plant are to be found in the high sierra regions, or *puna*. Moreover, its geographic distribution is similar to the typical form, extending from the Departments of Ancash, Huánuco and Pasco in northcentral Peru to Arequipa in the south, and encompassing, in between, portions of the Departments of Junín, Lima, Huancavelica, Ayacucho, Apurímac, Cusco and Puno. Overall, its range extends from approximately 11°25' S and 76°35' W to 15°50' S and 70°01' W. (Map 22).

Plants of *S. bukasovii* f. *multidissectum* are not infrequently found growing along with or near the typcial form of this species. This was the case, for example, with the three collections of *S. bukasovii* f. *multidissectum* (*Ochoa 37, 507 and 1007*) and the one typical collection of this species (*Ochoa 11301*) that were obtained by the author at the Punas de Casaracra, Junín, in central Peru. The same situation was seen to exist in the high mountains of Chacapalpa, Junín, were several collections of *S. bukasovii* f. *multidissectum* (*Ochoa 270, 1006 and 2026*) were growing at the same locality as the typical species (*Ochoa 12560*).

Other examples of *S. bukasovii* f. *multidissectum* growing in association with plants of the typical species were observed in the highlands of Huancavelica and Ayacucho. For instance, at Puente Santo Domingo (3895 m alt.) above the Apurímac River in the Province of Espinar, Cusco, a mixed plant collection of typical *S. bukasovii* and its forma *multidissectum* was obtained by Vargas from a site that was located in the near proximity of the type locality of *S. canasense*. Unfortunately, the plants of this collection were all assigned the same field no. (*5646*), and, prior to their distribution to several herbaria, were glued to herbarium sheets without any regard for the taxa that were represented. Thus, while the herbarium at Cusco (CUZ) has only a single specimen of forma *multidissectum* mounted on a single sheet, the Lundell Herbarium (LL) has a sheet bearing two specimens of typical *S. bukasovii* and one of forma *multidissectum*; whereas, the writer's herbarium (OCH) includes a single sheet that bears just one example of each of the two taxa.

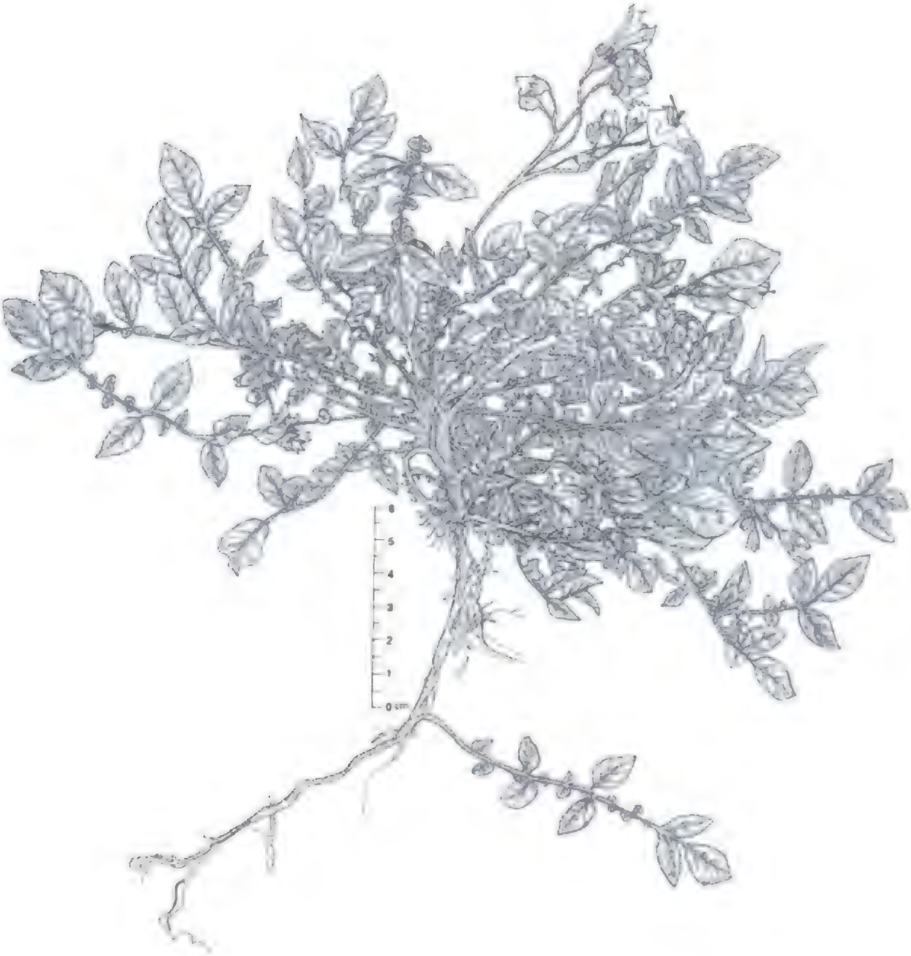


Figure 262. *Solanum bukasovii* f. *multidissectum* (*Vargas 5646 p.p.*, col. "*S. multidissectum*").

Lastly, considering the coextensiveness of the ranges of typical *S. bukasovii* and its forma *multidissectum* and the fact that these two taxa often occur together in the same habitats, the possibility that at least some gene exchange takes place between them appears to be very real. One collection that fits this possibility is *OCH 15306*, in which the flowers of the plants are very large and in appearance much like those of typical *S. bukasovii*, while the leaves, which are strongly divided, are much like those of forma *multidissectum*.

Specimens Examined

Department Apurímac

Province Antabamba: Cerro de Sabaino, 3600 m alt., facing Sabaino, leaves very divided, corolla purple, 3 cm in dia., 10 February 1960, *C. Ochoa 2255* (OCH).

Province Aymaraes: About 3 km from Cotaruse, 3350 m alt., heading up from Cotaruse to Chalhuanca, flowers violet, 3.0 cm in dia., calyx acuminate, berries ovoid, 26 March 1980, *C. Ochoa 13812*, 2n=24 (CIP, OCH, US).

Department Ayacucho

Province Huamanga: Palca, 3400 m alt., heading up the highway from the lower slopes of Condorcunca towards Tambo, growing near *S. bukasovii*, 10 February 1958, *C. Ochoa 2149A* (OCH). Huayopampa, 3000 m alt., near Pacaicasa, along the route Ayacucho-Huamanguilla, 20 March 1966, *C. Ochoa S-64* (= *PI-365366*), 2n=24 (CIP, OCH, US, from plants grown at Sturgeon Bay, Wis., U.S.A.).

Department Cusco

Province Acomayo: Cerro Wilcacalle, 4000 m alt., District of Pomacanchi, among plants of *Stipa ichu* and *Chuquiraga*, near cultivated fields of *Lupinus mutabilis* and barley, March-April 1981, *R. Ortega* 005 (OCH, from plants grown in 1982 at the Granja K'ayra, Cusco). Cerro Cruspata, 4100 m alt., District Pomacanchi, March-April 1981, *R. Ortega 012* (OCH, from plants grown in 1982 at the Granja K'ayra, Cusco). Cerro Canchapata, 4150 m alt., near Pomacanchi, March-April 1981, *R. Ortega 014* (OCH, from plants grown in 1982 at the station Exp. de K'ayra, Cusco). Semura Huayck'o, 3700 m alt., District Pomacanchi, n.v. *Alkko Papa* (= Dog Potato), among *Stipa ichu, Salvia, Chuquiraga*, near cultivated fields of maíz, quinua (=*Chenopodium quinoa*), tarwi (=*Lupinus mutabilis*), papa and barley, March-April 1981, *R. Ortega 017* (OCH,

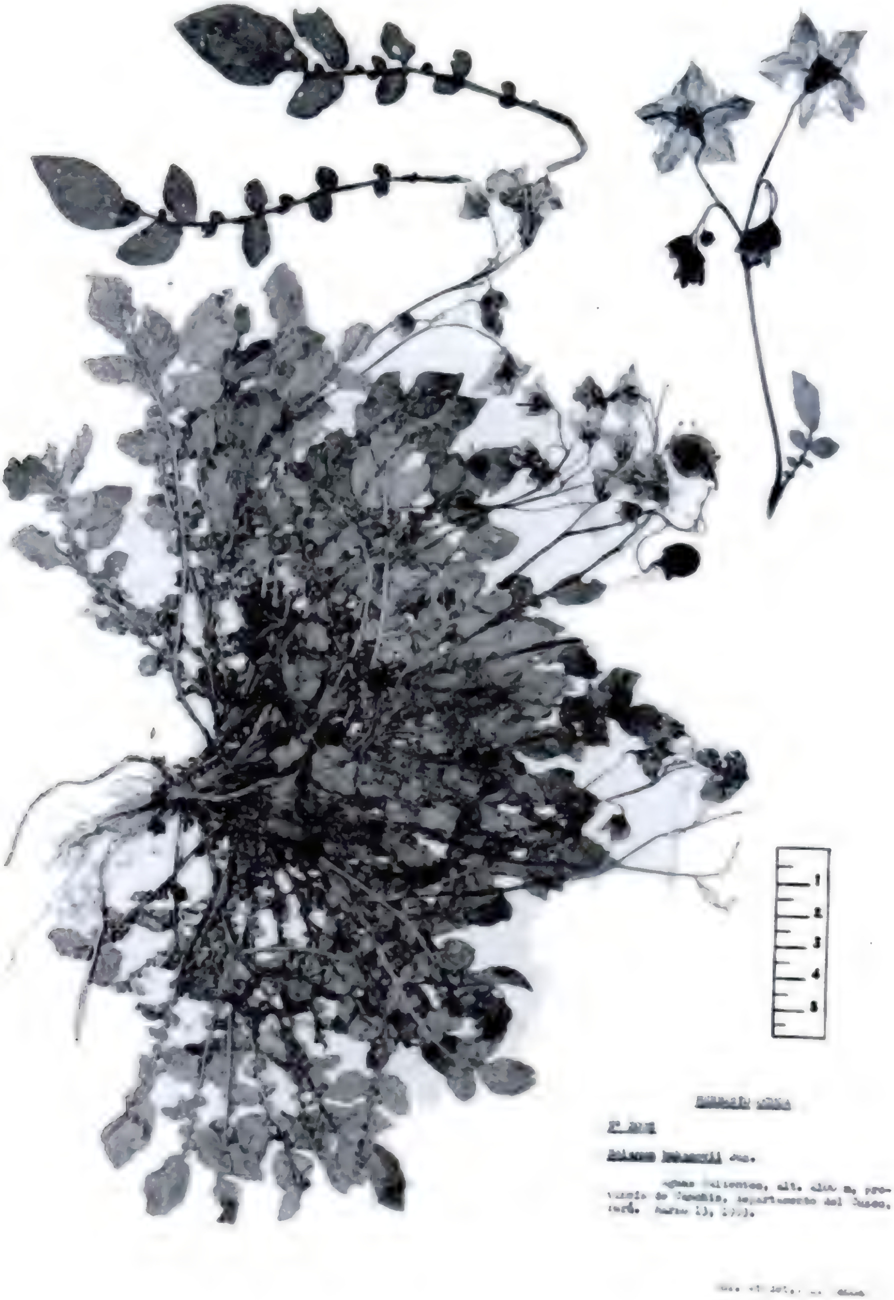


Figure 263. *Solanum bukasovii* f. *multidissectum* (*Ochoa 2028*), from Aguas Calientes, Department of Cusco.

from plants grown at K'ayra, Cusco). Cerro Apachita, 4200 m alt., District Pomacanchi, March-April 1981, *R. Ortega 028* (OCH, from plants grown at the station Exp. de K'ayra, Cusco).

Province Calca: Quebrada de Ccochocc, 2900 m alt., Calca, 24 February 1944, *C. Vargas C. 4087* (CUZ, LL, OCH, type collection of *S. canasense* var. *calcense* Vargas). Heading up to the ruins of Intihuatana, above the terraces of Pisacc, 3200 m alt., 24 April 1953, *C. Ochoa 2059* (OCH, US). Ruins of Intihuatana, above Pisac, 3300-3400 m alt., 24 April 1953, *Peterson and J.P. Hjerting 1517.2* (= *PI -210035*, US; *PI -210035-2*, LL, from plants grown at Sturgeon Bay, Wis.,U.S.A.). Between the terraces of Pisacc and the ruins of Intihuatana, 3100-3350 m alt., 16 February 1960, *C. Ochoa 2189* (OCH). Puma Mutt'u, 3400 m alt., heading up the Quebrada de Ccochocc, toward Totora, near Calca, growing near *S. bukasovii*, 19 February 1960, *C. Ochoa 2197* (OCH). Bottom of Rio Urubamba Valley at km 58 on road to Urubamba, ca. 8 km NE from Calca, 4 km from Yucay, 2900 m, weeds and natives in ungrazed rock pile in cornfield, *Solanum* sp., *Bomarea ovata, Phaseolus*, 29 December 1962, *H.H. and C.M. Iltis and D. and V. Ugent 906A* sheet 1, *906A* sheet 2, and *906B* (WIS). Between Pisac and Sondor, via Machacancha, 17 March 1980, *C. Ochoa 13771*, 2n=24 (CIP, OCH). Totora, 3600 m alt., along the route Calca-Amparaes, between Machacancha and Chaiña Gorge, 14 March 1981, *C. Ochoa 14316A* (CIP, F, NY, OCH).

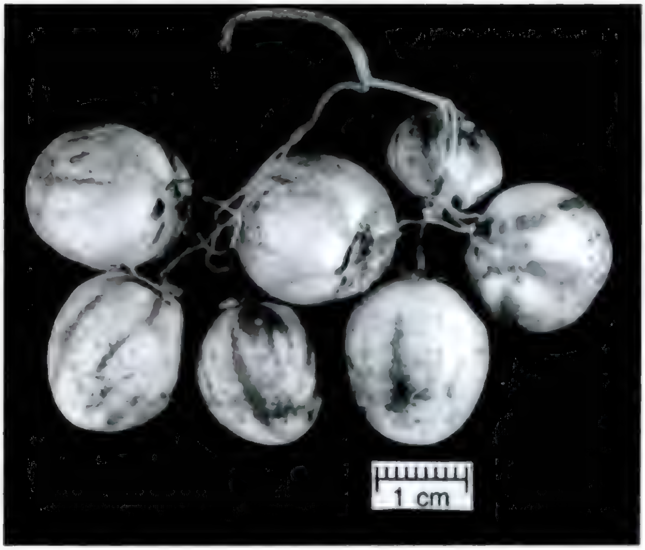


Figure 264. Fruits of *Solanum bukasovii* f. *multidissectum* (*Ochoa 13110*).

Province Canas: Environs of San Andres de Checca, 3825 m, in old walls, the plant in general is very pilose, long hairs from 6-8 mm long, with the ends curved, *Apfaruma*, 27 February 1939, *C. Vargas C. 11006* (CPC = 3 sheets; K = 1 sheet, from plants grown in Cambridge, England; F, US, from original plants, type collection of *S. multidissectum*; in CUZ as *C. Vargas C. 1541*, indicated as isotype of *S. multidissectum*, *sic* Vargas *Las Papas Sudperuanas* part I, pp. 98-99, 1949).

Province Canchis: Sicuani, 3500 m alt., in bare ground along fence at Evangelical Mission. January 8, 1963; *H.H. and C.M. Iltis and D. and V. Ugent 1224* (F, GH, OCH, WIS = 6 plants).

Province Espinar: Puente Santo Domingo, 3895 m alt., on rocky hillsides, corolla light blue, tubers long, 7-9 February 1946, *C. Vargas C. 5646 p.p.* (CUZ, LL, OCH).

Province Paruro: Toccorumi, 3620 m alt., along the route Yaurisque-Paruro, leaves very divided, associated with *Barnadesia, Begonia, Berberis, Calceolaria* and *Opuntia exaltata*, February 1980, C. *Ochoa 13581*, 2n=24 (CIP, OCH).

Province Quispicanchis: In Cusco valley, near Oropeza, about 13.000 ft. [or 4000 m], n.v. *Arakk Papa* (= Wild Potato), 12 May 1939, *E.K. Balls and J.G. Hawkes 6770* (K = *CPC-481.1* and *CPC-0485*, both from plants grown at Cambridge, England; *CPC-0485*, the other specimen on a separate sheet and *CPC-485.6*, type collection of *S. lechnoviczii* Hawkes and *6778* (CPC, also with the number *485*). Piquillacta, Inca wall near Oropeza, 3200 m, amidst ruins and on surrounding rocky hillsides, with *S. raphanifolium* and *S. canasense*, 2 March 1963, *D. and V. Ugent 4036* sheets 1, 2 (WIS) and *4038* sheet 2 (WIS). Rajch'i, 3400 m alt., near Oropeza, among rocks on the lower levels of the mountain, in gravel soils associated with bromeliads and cacti, plants 30-40 cm, leaves very divided, leaflets narrow, corolla small, purple, 2 February 1980, C. *Ochoa 13586*, 2n=24 (CIP, MOL, OCH, US, USM, topotypes of *S. lechnoviczii*). Near Chuquicahuana, 3700 m alt., between tufts of *Stipa* and protected by *Cajophora* sp., very rare, 16 February 1980, C. *Ochoa 13624* (CIP, OCH). Quebrada de Tintinco, 3550 m alt., about 4 km east of Chuquicahuana, on rocky slopes of Cerro Jampi Niño, among trees of *Buddleja and Escallonia*, n.v. *Maula Papa*, flowers purple, 12 March 1980, C. *Ochoa 13720*, 2n=24 (CIP, OCH, USM).

Province Urubamba: Heading up from Urubamba towards the Quebrada de Pumahuanca, 3000 m alt., 15 February 1960, *C. Ochoa 2180, 2184* and *2186* (OCH).

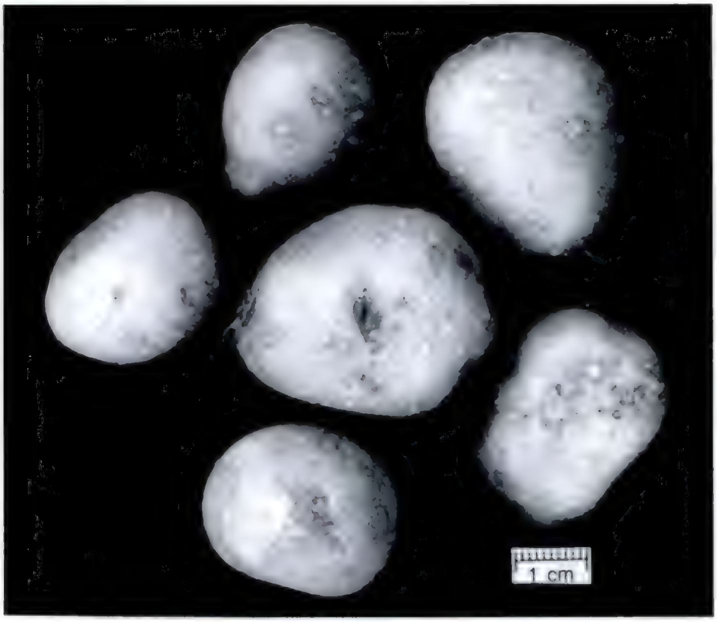


Figure 265. Tubers of *Solanum bukasovii* f. *multidissectum* (*Ochoa 13586*), *ca*. × 1/1.

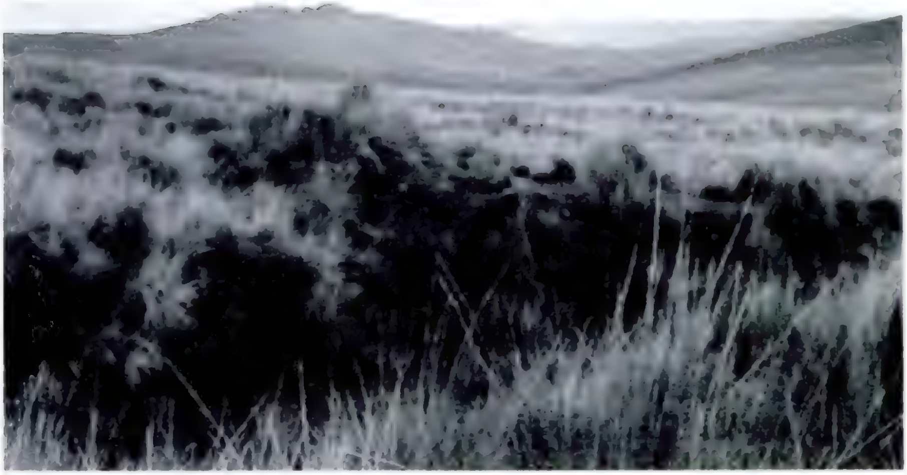


Figure 266. Plains of Canas, Cusco, habitat of *Solanum bukasovii* and *S. bukasovii* f. *multidissectum*.

Department Huancavelica

Province Huancavelica: Near km 35 of the road Huancavelica-Lircay, 3700 m alt., growing near *S. bukasovii*, 11 February 1979, *C. Ochoa 13173 p.p.*, 2n=24 (CIP, MOL, OCH, USM). 1 km before Huancavelica, along the route Huancavelica-Huancayo, 3800 m alt., 12 February 1979, *C. Ochoa 13176* , 2n=24 (CIP, F, MOL, OCH, US). Highlands of Antacocha, 4000 m alt., near km 66 of the Huancayo-Iscuchaca-Huancavelica road, in *puna* grasslands, 12 February 1979, *C. Ochoa 13177*, 2n=24 (CIP, MOL, OCH, US, USM).

Department Junín

Province Concepción: Quichuay, near Concepción, 3300 m alt., 28 March 1947, *C. Ochoa 75* (CIP, MOL, OCH, US). Lower slopes of Chijchi, 3650-3750 m alt., on talus slopes along the Concepción-Comas-Satipo road, flowers light blue or violet, large or medium-sized, 3-4 cm in dia., leaves very segmented, January 1978, *C. Ochoa 11843*, 2n=24 (CIP, MOL, OCH, US, USM).

Province Huancayo: Near Hacienda Acopalca, 4000 m alt., a little before the entrance, abundant, flowers blue, large, berries ovoid, 18 February 1951, *C. Ochoa 998*, 2n=24 (OCH, US). 32 km on Huancayo-Tarma road, 4000 m alt. April 4, 1953, *Peterson and Hjerting: 1366.1* and *1366.4*, 2n=24 (LL, from plants grown at Sturgeon Bay, Wis., USA).

Province Jauja: Uchupaca, 3580 m alt., near Los Molinos, about 7 km east of Jauja, along the route to Masma, right bank of the Querus River, growing on a sloping escarpment among shrubs of *Barnadesia*, *Cassia,* plants of *Bidens, Stipa ichu*, *Puya and Ranunculus,* near cultivated fields of potato, 9 February 1979, *C. Ochoa 13165* (OCH).

Province Tarma: Puna de Casaracra, 3800 m alt., about 15 km north of La Oroya, talus slopes of the Oroya-Cerro de Pasco railroad line, in sandy-clay soil, between tufts of *Stipa ichu*, 23 February 1947, *C. Ochoa 37* (CUZ, K, OCH, type collection of *S. neohawkesii* Ochoa*)*. Casaracra, 3800 m alt., along the route La Oroya-Junín, plant rosette-forming, leaves very divided, corolla deep blue, 3.0-3.5 cm in dia., May 1948, *C. Ochoa 507* (CPC, OCH, topotype of *S. neohawkesii*). Casaracra, 3700 m alt., in *puna* grasslands, along the route La Oroya-Cerro de Pasco, 14 March 1951, *C. Ochoa 1007* (OCH, topotype of *S. neohawkesii*). Huichay, 3200 m alt., near Tarma, among weeds at base of old adobe walls, 3 March 1953, *C. Ochoa 1984* (OCH). Casaracra, 3850 m alt., about 15 km from La Oroya toward Junín, type locality of *S. neohawkesii*, 9 April 1953, *Peterson and Hjerting 1340.1, 1340.2* (LL, US, from plants grown at Sturgeon Bay, Wis., U.S.A.). Above Ccoriccacca, 3650 m alt., between La Oroya and Chacapalpa, 22 January 1979, *C. Ochoa 13110*, 2n=24 (CIP, F, NY, OCH, US).

Province Yauli: Otuto, 4000 m alt., 1 km above Chacapalpa, growing in *puna* grasslands, in sandy-clay soils, plant rosette-forming, flowers deep blue and leaves very divided, 23 January 1948, C. *Ochoa 270* (OCH). Vicinity of Chacapalpa, 4000 m alt., plants small, rosette-forming, leaves very divided, flowers deep blue, 30 January 1948, C. *Ochoa 274* (OCH). Near bridge of Chacapalpa, 3500 m alt., flowers deep blue, 14 March 1951, C. *Ochoa 1006* (OCH). Chacapalpa, *puna*, 3800-3900 m alt., in grasslands, plants rosette-forming, small, among *Stipa ichu*, near *S. acaule*, 4 March 1953, C. *Ochoa 2026* (OCH). Cemetery of Chacapalpa, 3700 m alt., 31 January 1978, C. *Ochoa 11868*, 2n=24, (CIP, F, MOL, GH, NY, OCH, US).

Department Lima

Province Canta: Upper slopes of Cerro Jara, 3800 m alt., near Huaros, above Canta, in moist soils, among large rocks, 10 March 1977, C. *Ochoa 11305*, 2n=24 (OCH, US).

Province Huarochirí: Near Chicla, 3700 m alt., between San Mateo and Casapalca, in foothills of a rocky mountain, flowers purple, 26 January 1950, *R. Ferreyra 6521* (LL, OCH, USM). Near Chicla, 3650 m alt., heading up from Río Blanco towards Chicla, growing near *S. bukasovii*, among large rocks and stones, 1 April 1953, C. *Ochoa 2055 p.p.* (OCH). *Punas* between Millioc and Marcapomacocha, 4200 m alt., 16 February 1979, C. *Ochoa 13182*, 2n=24 (CIP, F, NY, OCH, US, from the original plants transplanted and grown in the CIP experimental fields at Huancayo) and *13183* (CIP, OCH).

Province Yauyos: Achucura, 3200 m alt., District Miraflores, right bank of the Río Miraflores, in thickets, 23 January 1981, *D. Bauman s.n.* (OCH).

Department Puno

Province Carabaya: Between Macusani and Nuñoa, 15 February 1948, C. *Vargas C. 7138* (CUZ, LL).

Province Melgar: Between Santa Rosa and Aguas Calientes, 4175 m alt., 17 km before Aguas Calientes, near Araranca, in a very dry plain area, above the river near road, 4 April 1971, *J.G. Hawkes, J.P. Hjerting, P J. Cribb* and *Z. Huamán 5082* (CIP). Between Ccaccachupa and Jaillahui, 4200 m alt., along the route Santa Rosa-La Raya, on rocky hillsides, near old stone corrals, plants rosette-forming, small, leaves very divided and with white flowers, near *S. acaule* and *S. bukasovii*, 24 January 1980, C. *Ochoa 13523*, 2n=24 (OCH), and *13524*, 2n=24, only plantlets were collected (OCH, from plants grown at Huancayo). Pijchu Alto, 4200-4300 m alt., between Ccaccachupa and Jaillahui, near La Raya Pass, along the route Santa Rosa-La Raya, on rocky hillsides or among old stone walls, plants very pubescent, some rosette-forming, leaves very divided, flowers purple, growing abundantly near *S. bukasovii*, 24 January 1980, *C. Ochoa 13528, 13529* and *13530* (OCH). Between Kunurana and Santa Rosa, 3950 m alt., along the route Juliaca-Santa Rosa, grassland, on moist black soils, growing with *S. acaule* and *Stipa ichu*, 24 January 1980, *C. Ochoa 13531* (OCH).

Province Puno: Ten km from Puno, on road to Juliaca, 3800 m alt., growing among rocks and boulders; plants low, bushy, flowers purple, rotate to rotate-stellate; plants common in rubble and among boulders, 22 February 1958, *D.S. Correll and E.E. Smith P196* sheet 1 (LL). Among loose rubble, 11 km from Puno on road to Juliaca, 3700 m alt., plants similar to P196 but flowers are lavender blue, 22 February 1958, *D.S. Correll and E.E. Smith P201* (LL). Cuturati Alto, 3850-3870 m alt., 1 km above Cuturati, facing the highway trunkroad Puno-Chucuito, among large rocks, very rare, 27 January 1980, *C. Ochoa 13548*, 2n=24 (OCH). Cerro Llampuna, 3950 m alt., above Camacani, between Chucuito and Juli, berries round, 27 January 1980, *C. Ochoa 13556*, 2n=24 (OCH, US).

54. *Solanum cajamarquense* Ochoa, Agronomía, Lima, 26(4):314-316, illustr., 1959.

Figs. 267-272; Map 26.

Plant erect to erect-ascending, (25-)40-50(-80) cm tall, densely pilose on all parts, hairs silvery-white; stem (4)6-8 mm in dia. at base, simple or branched, straight or flexible, light green or rarely marked with pigment along the basal one-third of its length and in the leaf axils, wings straight, 1.0-1.5 mm wide, hairs simple, silvery-white multicellular, hirsute to sericeous, 2-4 mm long; internodes (1.5-)3.0-4.0(-6.0) cm long, much more densely pilose along the upper one-third of the stem, leaf canopy and axils, hairs simple, long, mixed with very short tetraglobular glandular hairs. Stolons 70 cm or more long; tubers moniliform, round to ovoid, small, 1.0-1.5 cm long (Fig. 270). Leaves short and broad, (5.6-)9.0-20.5(-26.5) cm long by (4.0-)6.5-16.5(-19.0) cm wide, very pubescent and much more densely pubescent on the upper nerves, rachis, petioles and petiolules, also very densely pilose or puberulent below; leaves imparipinnate, with 2-3 pairs of leaflets and 3-7(-9) pairs of interjected leaflets; leaflet margins wavy-crenulate. Terminal leaflet larger to much larger than the laterals, (4.0-)5.0-10.5(-15.0) cm long by (3.0-)3.5-8.0(-11.0) cm wide, broadly ovate to suborbicular, apex shortly acuminate, base broadly rounded; lateral leaflets broadly elliptic-lanceolate to ovate-lanceolate, sessile or subsessile, apex abruptly pointed to shortly acuminate, base basiscopically auriculate or broadly rounded; the first pair of lateral leaflets (2-)4-7(-9) cm long by (1.0-)2.5-4.0(-5.5) cm wide, base usually broader along the basiscopic side, decurrent about the rachis. Interjected leaflets usually numerous, orbicular to ovate, de 1-6 mm long, sessile. Pseudostipular leaves broadly falcate, auriculate or clasping, 20 mm long by 13 mm wide. Inflorescence cymose, terminal and lateral, very floriferous, 10-20-flowered; peduncle 6-10 cm long, densely pilose as in the case of the pedicels and the calyx, forked 2-3 times; pedicels 20-30 mm long, articulated 5-6 mm below the base of the calyx. Calyx symmetrical, 6-7 mm long; lobes ovate to ovate-lanceolate the margins scarious at base, abruptly acuminate, acumens linear-spatulate, 2-3 mm long, pigmented. Corolla rotate, white, 2.5-3.0 cm in dia. (Fig. 268), with a yellow internal star. Anthers broadly lanceolate, 5.5-6.5 mm long, distinctly cordate at base; filaments slender, 0.5 mm long, glabrous. Style 10.0-10.5 mm long, exerted 2.5 mm, densely papillose in the upper two-thirds of its length, sparsely and finely pilose or setose in the upper one-third of its length; stigma capitate. Fruit round, 1 cm in dia., light green, with vertical green-violet stripes (Figs. 267, 269). Chromosome Number: 2n=24. EBN=1.

Type: PERU. Department and Province of Cajamarca, Lanchi, 2600 m alt., near Chiquidén, along the route from San Juan to Paso del Gavilán, 17 May 1952, *C. Ochoa 1490* (holotype OCH, isotypes F, GH, MOL, USM).

Affinities

This species is totally unique and does not appear to be closely related to any other species within Series Tuberosa. However, as it shares a few characteristics in common with *S. hypacrarthrum*, such as the short, broad leaves and an enlarged terminal leaflet that has a similar shape, the two may be distantly related.

Habitat and Distribution

Solanum cajamarquense grows in the medium-altitude, cool to temperate interandean valleys of Peru, where it commonly thrives at elevations between 2000 and 2600 m, although occasional individuals are encountered between 2800 and 3000 m. It often occurs on rocky mountain slopes with various species of cacti, such as *Opuntia exaltata* and *O. ficus-indica*, or near cultivated fields and in quebradas. In the latter areas, *S. cajamarquense* grows in rich soil in thickets

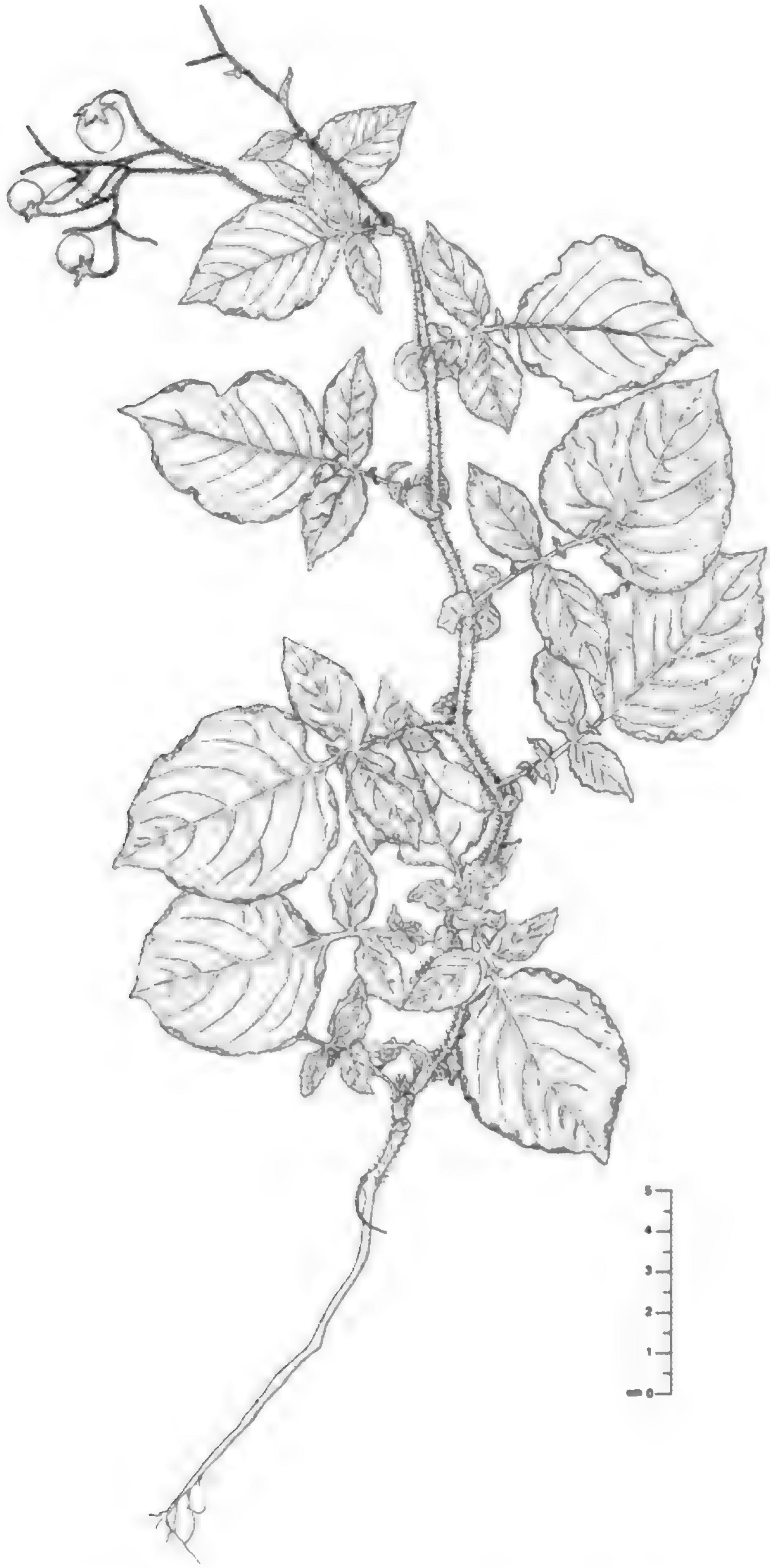


Figure 267. *Solanum cajamarquense* (*Ochoa 1490*, isotype).

of herbs and shrubs, where it is associated with *Salvia*, *Bidens*, *Lycopersicon*, *Festuca*, *Eupatorium*, *Verbena*, *Oxalis*, *Plantago*, *Solanum nigrum*, *S. radicans* and *S. ochrophyllum*.

This species is presently known only from the Provinces of Cajamarca, Contumazá and San Pablo in the Department of Cajamarca in northern Peru (Map 26).

Specimens Examined

Department Cajamarca

Province Cajamarca: Lanchi, 2600 m alt., near Chiquidén, along the route from San Juan to Paso del Gavilán, 17 May 1952, *C. Ochoa 1490*, 2n=24 (F, GH, MOL, OCH, USM, type collection of *S. cajamarquense*). On talus slopes, 29 km from Cajamarca, along the route to Chilete, 2650 m alt., flowers white, rotate-stellate, tubers whitish, oblong, 24 March 1960, *D.S. Correll and E.E. Smith P848* (G, K, LL, MO, NY, S, U, UC, US). Heading down from Paso del Gavilán to San Juan, on mountain slopes, 3000 m alt., 30 March 1964, *C. Ochoa and J.G. Hawkes 2567* (MOL, OCH, USM). Heading down from Paso del Gavilán to within 1 km of San Juan, 2750 m alt., in foothills of a rocky mountain, 30 March 1964, *C. Ochoa and J.G. Hawkes 2570* (MOL, OCH, USM). Near San Juan, 2500 m alt., heading up to Paso del Gavilán, 1 April 1976, *C. Ochoa 10718* (OCH, topotype). El Potrero, 2700 m alt., in the foothills of Cerro Carambayo, 2 km northwest of San Juan, 2 April 1992, *C. Ochoa and A. Salas*

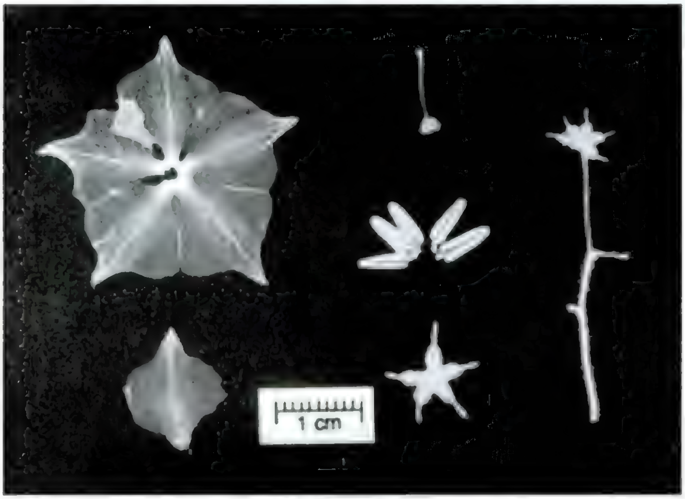


Figure 268. Floral dissection of *Solanum cajamarquense* (*Ochoa and Salas 16118*).

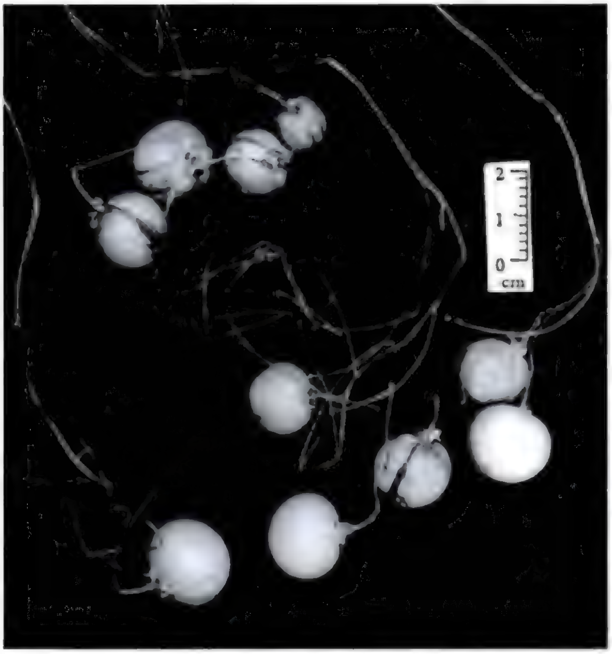


Figure 269. Fruits of *Solanum cajamarquense* (*Ochoa and Salas 16118*).

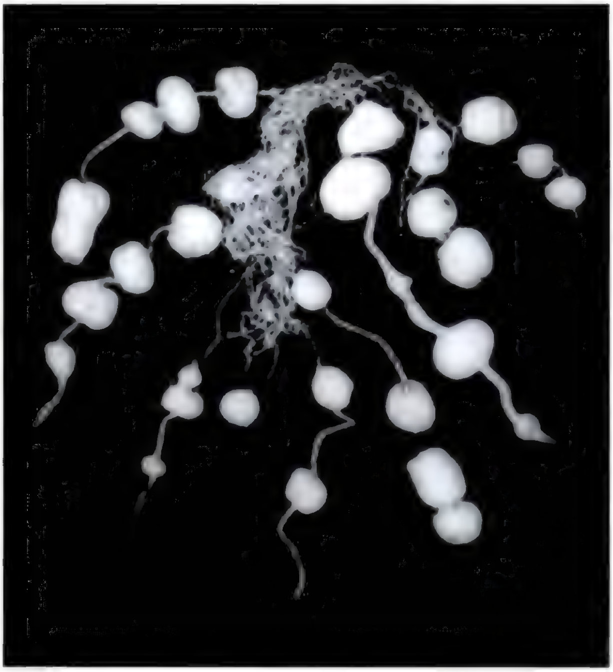


Figure 270. Tubers and tuberization of *Solanum cajamarquense* (*Ochoa and Salas 16131*).

16062 (CIP, MOL, OCH) and *16063* (CIP, MOL, OCH, USM). Agua Fría, 2680 m alt., near El Potrero, 3 km northwest of San Juan, in thickets of *Lupinus, Ipomoea* and various composites and grasses, 3 April 1992, *C. Ochoa and A. Salas 16064* (CIP, MOL, OCH, US) and *16065* to 1/2 km from Agua Fría (CIP, OCH, US, USM). Marcus, 2800 m alt., between San Juan and Paso del Gavilán, 30 April 1992, *C. Ochoa and A. Salas 16118* (MOL, CIP, OCH, plants grown at La Molina, Lima) and *16119*, near Marcus (CIP, OCH, from plants propagated

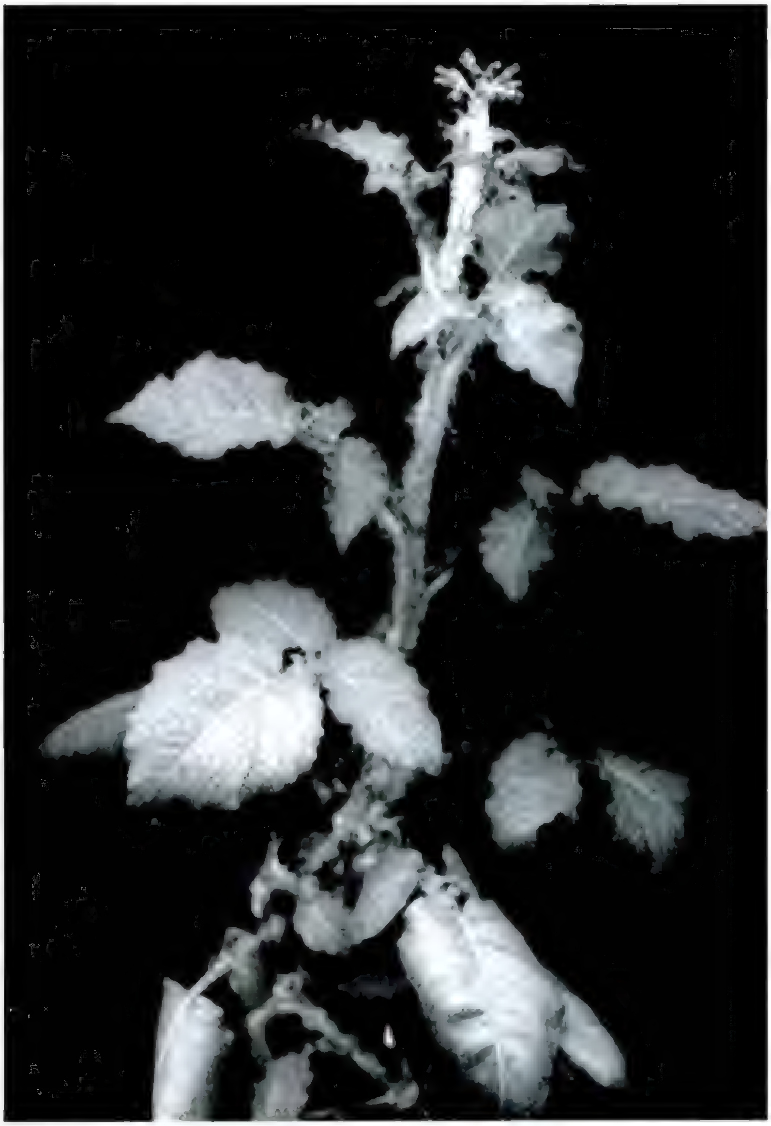


Figure 271. Plant of *Solanum cajamarquense* in its natural habitat.

in the greenhouse at Huancayo). Chupacatay, 2800 m alt., facing Cerro Carambayo, 30 April 1992, *C. Ochoa and A. Salas 16121* (OCH) and (CIP, MOL, OCH, from plants propagated in the greenhouse at Huancayo). Between Chupacatay and Carambayo, 2900 m alt., 30 April 1992, *C. Ochoa and A. Salas 16122* (CIP, OCH, from plants propagated in the greenhouse at Huancayo), *16123* (CIP, OCH, from plants propagated in the greenhouse at Huancayo) and *16125* (OCH, from plants grown in the greenhouse at Huancayo).

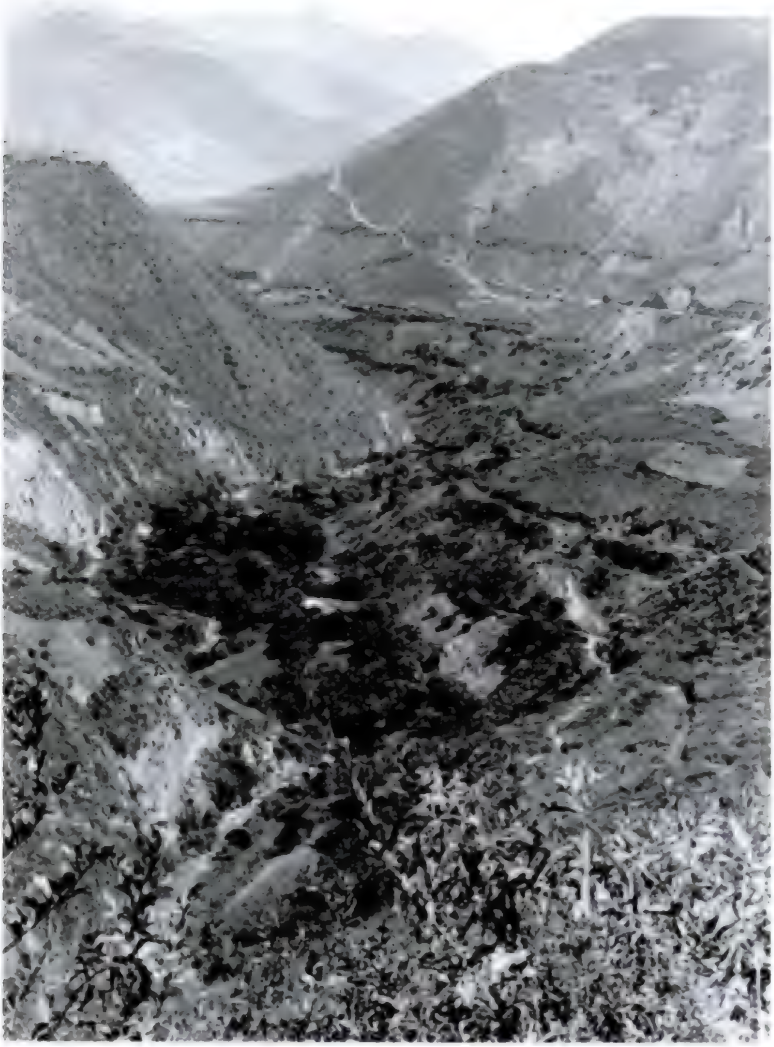


Figure 272. Quebrada just south of San Juan, Cajamarca, habitat of *Solanum cajamarquense.*

Province Contumazá: Between Chilete and Contumazá, *ca.* 2200 m alt., among columnar and spherical cacti, very rare, 1 April 1976, *C. Ochoa 10742* (CIP, OCH). Near the crest of Cerro Chungarrán, 2900 m alt., District Guzmango, between San Benito and Guellón, 1 April 1976, *C. Ochoa 10746* (CIP, MOL, OCH, USM). Lledén, between Cascas and Contumazá, ca. 2600 m alt., 13 May 1980, *C. Ochoa 13971*, 2n=24 (CIP, MOL, OCH). La Ramada, 2200 m alt., along the route Cascas to Contumazá, before crossing the tunnel, 26 April 1995, *C. Ochoa and A. Salas 16238* (CIP, MOL, OCH, USM). Nondón, 2500 m alt., along the route Cascas to Contumazá, after the tunnel, in foothills of a rocky mountain, 26 April 1995, *C. Ochoa and A. Salas 16239* (CIP, MOL, OCH, US, USM). Shillar, 2500 m alt., along the route Contumazá-Chilete, on rocky slopes and among large colonies of columnar cactus and *Lupinus* sp., 26 April 1995, *C. Ochoa and A. Salas 16241* (CIP, MOL, OCH, US, USM, UNTC). La Lucma, 2000 m alt., heading up from Trinidad to Cerro Calabe, on rocky hillsides and in forests of wild lucma (= *Pouteria* sp.), 4 May 1995, *C. Ochoa and A. Salas 16242* (CIP, OCH). Montaña de Clarín, 2700 m alt., along the foot trail from Totorilla to Cholol, among large rocks and in herb and shrub thickets growing near *Solanum* aff. *trinitense*, begonias and many composites, 4 May 1995, *C. Ochoa and A. Salas 16253* (CIP, OCH).

Province San Pablo: Choloque, 2300 m alt., above San Pablo, April 1978, *C. Ochoa and A. Salas 12547* (CIP, MOL, OCH, US, USM).

55. *Solanum candolleanum* Berth., Ann. Sci. Agron. Franc. & Etrang., Paris, ser. 3, 6(2):184, 185, 190, Plate 1 (p. 292), 1911.

Fig. 273; Map 23.

S. mandoni A. DC. Bibl. Univ. Arch. Sci. Phys. et Nat., ser. 3, 15:438, 1886, (not *S. mandonis* van Heurck et Muell. Arg. in Heurck, *Obs. Bot.*, 78, 1870).

Plant erect, robust, up to 1 m or more tall, sparsely pilose; stem simple or branched, 1-2 cm in dia. at base, irregularly pigmented or slightly pigmented deep violet, wings 1-2 mm wide, coarsely pilose, hairs unequally 2-4 mm long; internodes 4-7(-8) cm long. Stolons up to 1.5 mm long by 3-4 mm in dia., white, fleshy; tubers white, ovoid, round to ovoid compressed, exceptionally large, up to 12 cm long, lenticulate, eyes superficial, flesh white. Leaves large, (12.5-) 17.0-30.0(-35.0) cm long by (8.5-)13.5-16.0(-28.0) cm wide, grayish-green and coarsely pubescent above, lighter green and densely pilose below, hairs thick and short; leaves imparipinnate with (3-)4-5(-6) pairs of lateral leaflets and (3-)6-12

(-16) pairs of sessile interjected leaflets of different size, 1-10 mm long, orbicular to ovate. Leaflets elliptic-lanceolate or narrowly elliptic-lanceolate, less frequently ovate-lanceolate or oblong, apex acuminate or subacuminate, base rounded to obliquely rounded, on petiolules 1.5-5.0(-7.0) mm long. Terminal leaflet generally somewhat larger than the laterals, 4.5-10.0(-12.5) cm long by 2-4(-6) cm wide; the first pair of lateral leaflets 4-7(-12) cm long by 1.5-3.0(-3.5) cm wide, occasionally narrow decurrent about the rachis along the basiscopic side. Pseudostipular leaves broadly falcate to obliquely semiovate, up to 18 mm long by 8 mm wide. Inflorescence cymose or cymose-paniculate, terminal or lateral, 10-18-flowered; peduncle slightly pigmented, vigorous, up to 15-18 cm long by 2.5 mm in dia., pilose, hairs 1-2 mm long; pedicels light green, 15-25(-30) mm long, more densely pilose than the peduncles, articulated above the center to 8-10 mm below the base of the calyx. Calyx 10-12 mm long, symmetrical, coarsely and densely pilose, lobes ovate-lanceolate to subcuadrate, margins scarious at base, abruptly narrowed to the lanceolate or linear-lanceolate, pointed apex, the latter 1.5-2.0 mm long. Corolla rotate, (2.5-)3.5-4.0 cm in dia., blue-violet or deep purple, lobes 18-20 mm wide by 5 mm long including the very short, 2-3 mm-long acumen. Anthers 5-6 mm long by 1.5-2.0 mm wide. Style 10-11 mm long, densely papillose along the lower two-thirds of its length; stigma claviform. Fruit globose to ovoid, green, or green with vertical purple stripes and sprinkled with small white dots. Chromosome Number: 2n=24 and 2n=36. EBN=2 (in diploids).

Local Names: *Achochil Choke* for the plant and *Mamunco* for the fruit in Sorata, Bolivia.

Type: BOLIVIA. Department La Paz, Province Larecaja, in rocky foothills of Mt. Illampu, Lancha de Cochipata, vicinity of Sorata, 3500 m alt., November 1858, *G. Mandon 397 p.p.* (holotype G, isotypes BM, K, P, W).

In 1886, Alfonso DeCandolle made a brief diagnostic description of the species S. *mandonii*. This was based on a collection by Mandon (*397*) that was housed in the Geneva Herbarium. However, in 1911, Berthault changed the name of this plant to *S. candolleanum* (but in the process erroneously citing Mandon's field number as *997* instead of *397*). The reason Berthault chose to rename Mandon's plant had to do with his discovery of an earlier name in the literature that was nearly identical to the one that had been applied by DeCandolle. The species that concerned him was the non tuber-bearing species *S. mandonis* that had been described by Van Heurck and Mueller in 1870. This name is given above as a synonym.

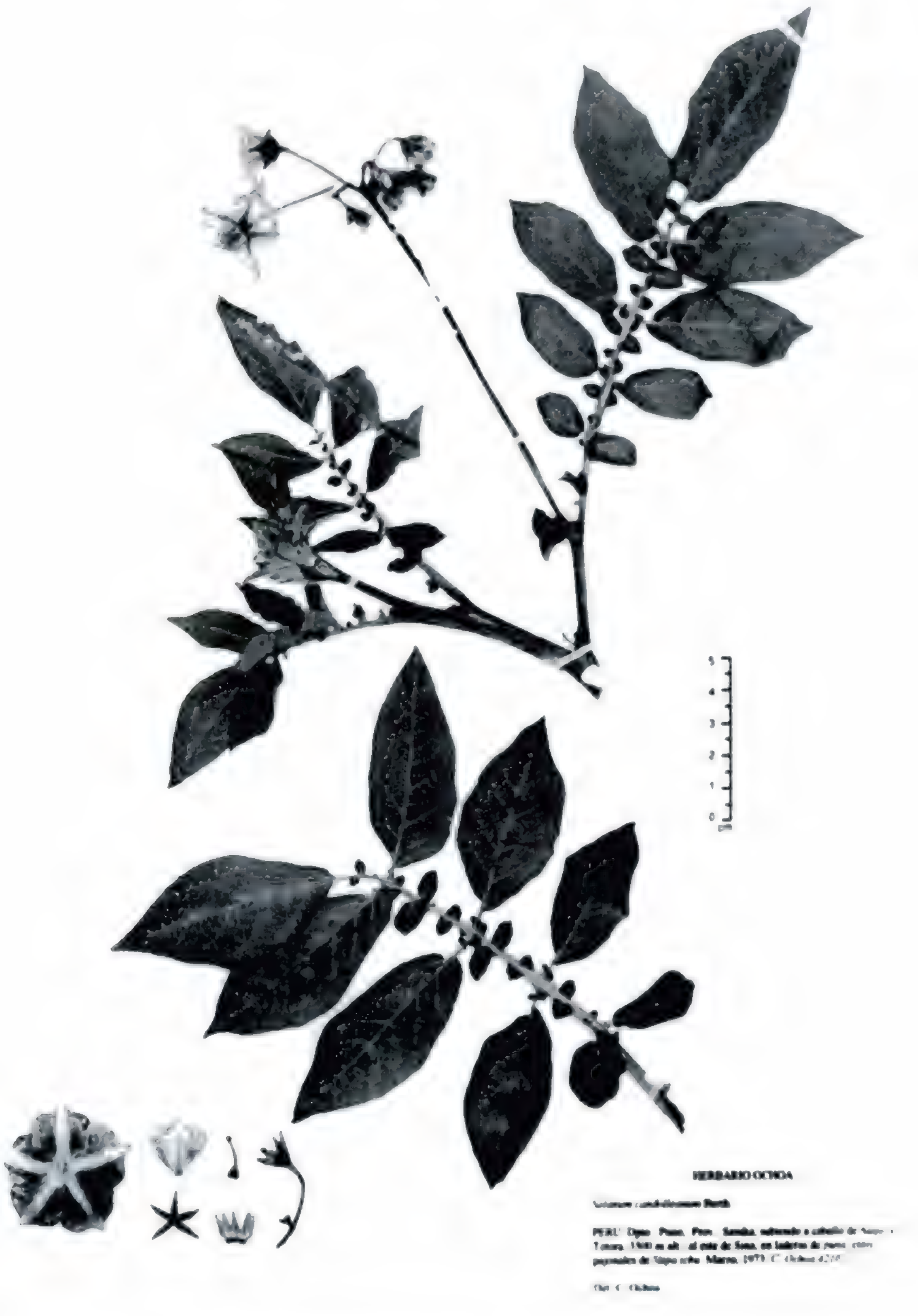


Figure 273. *Solanum candolleanum* (*Ochoa 4210*).

Correll (1962), who examined one element of the type collection of *S. candolleanum* in the Paris Herbarium (sheet No. *315*), noted that there are actually two plants mounted on the same sheet, one of which represents the upper flowering stem of *S. tuberosum sensu lat*, while the other is that of the stated species. The same situation occurs in the Kew Herbarium, where there is also a mixed sheet of *S. candolleanum* (No. *208*). However, there appears to be little doubt that Berthault used the non-mixed collection of this species in the Herbarium at Geneva for the making of his original species diagnosis. Therefore, it is this sheet which should be taken as the holotype for this species.

The location of the type locality for this species, as pointed out by Hawkes and Hjerting (1969), was not given precisely by Mandon, who simply wrote, "Vicinis Sorata, in scopulis montis Illampu (Lancha de Cochipata)." Gilbert Mandon, a mining engineer from France who resided for some time in Sorata and who was a great collector of plants, possibly confused the native Quechuan word *Kancha*, for a corral or a small open space, with the Spanish word *Lancha*, which means a launch or boat. Cochipata, on the other hand, is a small hamlet situated at a fairly high altitude in the mountains above the town of Sorata, which in turn is located just a short distance away from the rocky foothills of the great snowfields of Mt. Illampu.

According to Hawkes and Hjerting (1969), the specimens represented in the Mandon (No. *397*) collection are of two types depending upon whether the leaves are weakly or strongly divided. The first kind is referred to by the above authors as the "undissected type," even though the leaves of these plants are in reality divided. Typically, the plants of this category have 4-5 pairs of lateral leaflets and 3-6 pairs of interjected leaflets. Examples of this class are to be found amongst the herbarium collections housed at Geneva, the British Museum and Vienna (sheet 1). The plants of the second category, which are referred to as the "dissected type" by Hawkes and Hjerting, have 6-7 pairs of lateral leaflets and up to 14 pairs of interjected leaflets. Examples of this kind are found amongst the collections housed at Kew, Paris and Vienna (sheet 2). Significantly, Hawkes and Hjerting identified the plants of their first category as belonging to the species *S. candolleanum*, but left those of their second class as undetermined, *i.e.*, without a name. However, it is the contention of the present author that these undetermined collections are really nothing more than naturally occurring variants of this same species. This was borne out on a number of occasions by the field studies made by the present author in Peru and Bolivia, as well as under the more controlled conditions that are to be met with in the greenhouses and experimental fields at CIP. As it turned out, no matter which environment the plants of this species were observed, they tended to be greatly variable in leaf segmentation. All in all, plants of this species may have from as little as 4-5 pairs of lateral leaflets and 3-7 pairs of interjected leaflets to as many as 6(-7) pairs of lateral leaflets and 10-16 pairs of interjects. No other important morphological differences were observed between the plants of this species, except in the case of certain triploid (2n=36) Bolivian clones (*cf.* OCHS-14983 and OCHS-14986; Ochoa, 1990) and Peruvian clones (OCH-4200 and OCHS-15022) which have a slight natural tendency toward greater plant vigor and more pronounced leaf dissection.

Affinities

This species shows some relationship to *S. bukasovii*. The two are especially close with regard to leaf dissection, but have dissimilarly shaped leaflets. Moreover, the two differ with regard to several other important features of the plant, including habit and corolla shape, as well as in the details of the calyx and stigma.

Habitat and Distribution

Solanum candolleanum occurs in both the *ceja de montaña* and the cool, moist *puna* formations of southern Peru at elevations ranging between 3200 and 4000 m. It is found in open, grassy fields, on rocky mountain foothills covered with lichens and mosses, in shrub or tree forests and in thickets formed principally of *Bromus*, *Rubus*, *Salpichroa*, *Blechnum*, *Tropaeolum*, *Oxalis*, *Salvia* and many composites.

This species is common to both Peru and Bolivia. It occurs from the Provinces of Camacho, Franz Tamayo, Larecaja, Muñecas and Omasuyos of the Department of La Paz in northwest Bolivia to the Province of Sandia in the Department of Puno in southeastern Peru. (Map 15). The two countries are separated by the Cordillera de Apolobamba which has some mountain peaks, such as the Palomani Grande and Chaupi Orkko, that attain more than 5900 m and 6000 m in elevation, respectively.

Specimens Examined

Department Puno

Province Sandia: Vicinity of Sina, 3100 m alt., abundant, in thickets, March 1973, *C. Ochoa 4199*, 2n=24 (CIP, MOL, OCH). Along the horse trail from Sina to Quiaca, 3000 m alt., March 1973, C. *Ochoa 4200*, 2n=36 (OCH). Heading up to caballo from Saqui to Totora, 3500 m alt., east of Sina, on hillsides covered with *puna*, in grasslands of *Stipa ichu*, March 1973, C. *Ochoa*

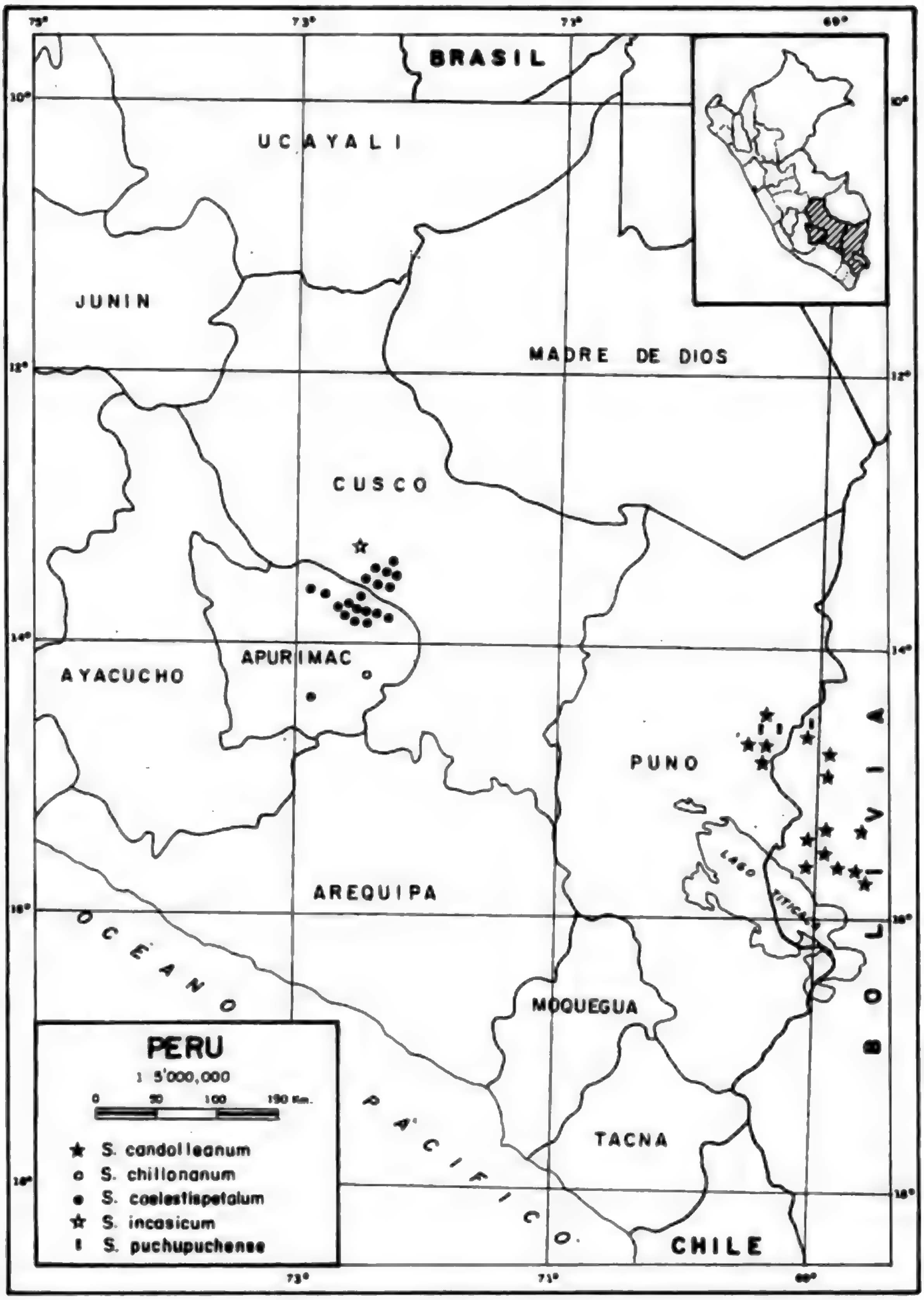
4210, 2n=24 (CIP, MO, MOL, OCH). In punas east of Saqui, 3600 m alt., heading up from Saqui toward the Cuesta de Totora by horseback, in grasslands of *Stipa ichu*, March 1973, *C. Ochoa 4213* (CIP, GH, MO, MOL, OCH). Near the mountain crest of Totora, 3600 m alt., in a shrubby quebrada, going down from Totora by the Pablobamba railroad line, February 1983, *C. Ochoa and A. Salas 15015B* (CIP, MO, MOL, OCH, US). Near Chimpachina Pampa, 3200 m alt., several km south-southeast of Sina, along the banks of the Jirgachi River, flowers large, dark purple, 13 February 1983, *C. Ochoa and A. Salas 15022*, 2n=36 (CIP, MOL, OCH; and F, GH, MO, US, from plants grown at Huancayo). Near Chimpachina Pampa, south-southeast of Sina, flowers violet-lilac, 13 February 1983, *C. Ochoa and A. Salas 15023*, 2n=24 (CIP, F, GH, MO, MOL, OCH, US).

Breeding Potential

The results of crosses of *S. candolleanum* with diploid (2n=24) species with EBN=1 and 2, tetraploids (2n=48) with EBN=2 and 4 and hexaploids (2n=72) with EBN=4 are given in Table 66, while the field materials used for these experiments are shown in Table 67.

Partially compatible results were obtained when *S. candolleanum* was crossed with *S. mochiquense* and *S. circaeifolium*, but only when the latter two species were used as the staminate parents. The unilateral cross made with *S. raquialatum* was also successful, but yielded only a low average number of seeds per berry. However, a large number of seeds per berry (up to 194) were obtained in reciprocal crosses of this species with *S. raphanifolium*, *S. bukasovii*, *S. bukasovii* f. *multidissectum* and *S. orophilum*. Seed yield was also excellent when *S. candolleanum* was used as the pistillate parent in crosses involving *S. phureja*, *S. saxatilis*, *S. sparsipilum*, *S. marinasense*, *S. coelestispetalum* and *S. litusinum*, and much less so when it was used as the staminate parent. Poor seed yield was also obtained in reciprocal crosses involving *S. candolleanum* and *S. goniocalyx*. On the other hand, unilateral crosses involving this species and *S. boliviense*, *S. sogarandinum*, *S. oplocense-2x* and *S. brevicaule*, gave excellent results. With respect to *S. chomatophilum*, crosses between this species and *S. candolleanum* failed when *S. chomatophilum* was used as the pistillate parent, and resulted in but few seeds per berry when this species was used as the staminate parent. Yields were much higher, however, when *S. chomatophilum* f. *sausianense* was used as the staminate parent.

Unilateral crosses with *S. acaule* were successful, yielding populations of F_1 plants bearing violet or dark purple rotate-pentagonal corollas, erect stems and large, poorly divided leaves, these without interjects and having but 2-3 pairs



Map 23. Distribution of *S. candolleanum, S. chillonanum, S. coelestispetalum, S. incasicum* and *S. puchupuchense.*

of lateral leaflets. And, the unilateral interspecific crosses made with *S. infundibuliforme* were especially surprising, yielding berries having 460 seeds each on the average.

Reciprocal crosses made with *S. tuberosum* subsp. *andigena* were most successful when this species was used as the staminate parent. Some of the F_1 plants derived from this cross were similar in habit and leaf characteristics to *S. tuberosum* subsp. *andigena*, whereas others tended to be more like *S. candolleanum* in appearance. Flower size and color of the hybrids also varied, and this was seen to be dependent upon the particular cultivar of *S. tuberosum* subsp. *andigena* that was used in the cross. Generally, the flowers were either large (3.5-4.0 cm in dia.) or small (2.5-3.0 cm in dia.), and colored either blue, violet or purple.

The seeds obtained from unilateral crosses of *S. candolleanum* with *S. sucrense* were highly viable. The populations derived from this cross were floriferous and showy in the F_1 generation, and were very similar in habit and leaf characteristics to *S. sucrense*.

Lastly, highly viable seeds were obtained in unilateral crosses of this species with *S. albicans*, even though the overall seed production, in this case, was only moderate. The F_1 hybrids varied considerably in appearance, depending upon the accession of *S. candolleanum* that was used originally in the cross. The genes of *S. candolleanum* were seen to be dominant in most cases, save for a few plants that bore erect, flexuous stems of a type more characteristic to those of *S. albicans*.

Table 66. Fertility of *Solanum candolleanum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	CIRCAEIFOLIA	× *S. circaeifolium*	4(4)	2(2)	24(0)
24	1	INGAEFOLIA	× *S. raquialatum*	3	2	10
24	1	MEGISTACROLOBA	× *S. dolichocremastrum*	26(15)	18(6)	0(0)
24	1	TUBEROSA	× *S. immite*	7(6)	3(4)	0(0)
			× *S. mochiquense*	13(10)	6(6)	44(0)
24	2	CONICIBACCATA	× *S. chomatophilum*	7(6)	6(4)	14(0)
			S. chomatophilum f. *sausianense*	6	1	54
			× *S. limbaniense*	25(33	16(18)	78(91)
			× *S. neovavilovii*	6(6	4(2)	67(67)
24	2	CUNEOALATA	× *S. infundibuliforme*	5	5	460
24	2	MEGISTACROLOBA	× *S. boliviense*	25	21	127
			× *S. raphanifolium*	39(8)	28(15)	194(107)
			× *S. sogarandinum*	3	1	105
24	2	PIURANA	× *S. piurae*	2	2	4
24	2	TUBEROSA	× *S. ambosinum*	6	3	0(0)
			× *S. brevicaule*	3	3	96
			× *S. bukasovii*	270(218)	215(176)	113(170)
			S. bukasovii f. *multidissectum*	18(24)	18(21)	151(166)
			× *S. coelestispetalum*	9(90	5(7)	117(43)
			× *S. goniocalyx*	24(19)	19(15)	46(80)
			× *S. marinasense*	5(2)	4(2)	125(50)
			× *S. medians-var. autumnale-2x*	7(10)	1(10)	0(0)
			× *S. microdontum* var. *montepuncoense*	5	2	0
			× *S. oplocense*-2x	14	8	100
			× *S. orophilum*	66(25)	49(190)	125(187)
			× *S. phureja*	13(3)	9(1)	173(4)
			× *S. saxatilis*	5(1	5(1)	161(30)
			× *S. sparsipilum*	76(56)	61(44)	139(74)
24	2	YUNGASENSA	× *S. litusinum*	38(10)	21(1)	108(10)
48	2	ACAULIA	× *S. acaule*	4	4	55
48	4	TUBEROSA	× *S. tuberosum* ssp. *andigena*	56(10)	41(5)	20(3)
			× *S. sucrense*	20	8	100
72	4	ACAULIA	× *S. albicans*	4	3	37
72	4	TUBEROSA	× *S. oplocense*-6x	17	16	0

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 67. Collections (OCH) used in *Solanum candolleanum* fertility studies.

ACAULIA
S. acaule 11983
S. albicans 13395

CIRCAEIFOLIA
S. circaeifolium 11806, 11909

CONICIBACCATA
S. chomatophilum 11046, 13205, 13210
S. chomatophilum f. *sausianense* 13840
S. limbaniense 14288, 14290, 14291
S. neovavilovii 14993, 14994

CUNEOALATA
S. infundibuliforme 13941

INGAEFOLIA
S. raquialatum 13947

MEGISTACROLOBA
S. boliviense 11935, 11937
S. dolichocremastrum 12072
S. raphanifolium 7619, 13597, 13625, 13775, 14296
S. sogarandinum 13324

PIURANA
S. piurae 11615

TUBEROSA
S. ambosinum 11865
S. brevicaule 11934
S. bukasovii 5106, 7953, 8693, 11058, 11301, 11306, 11841, 11844, 11870, 11871, 11872, 11873, 11874, 13106, 13115, 13166, 13168, 13173, 13174, 13559, 13822, 13856, 13858, 13859,13862, 13866, 13867, 14381
S. bukasovii f. *multidissectum* 11843, 13581
S. candolleanum 11805, 11814, 11835, 11896, 11897, 11913, 14958, 14959, 15002, 15004, 15011, 15012, 15022, 15023
S. coelestispetalum 13609, 13801, 14326
S. goniocalyx 00001, 14502
S. immite 13346
S. marinasense 11318, 13738
S. medians-2x 11637, 11638
S. microdontum var. *montepuncoense* 12025
S. mochiquense 14870
S. oplocense (2x) 11927
S. oplocense (6x) 11972
S. orophilum 12077, 12079, 13003
S. phureja 5443, 14460, 15071
S. saxatilis 15082
S. sparsipilum 8358, 11820, 11822, 11893, 12028, 12030, 12035
S. sucrense 11926
S. tuberosum subsp. *andigena* 11828, 11920, 11975, 15027, 15031, 15032, 15033, 15040

YUNGASENSA
S. litusinum 12027

56. *Solanum chancayense* Ochoa, Agronomía, Lima, 26(4):316-318, illustr., 1959. Figs. 274-278; Map 24.

Plant bushy, usually small, (10-)15-25(-30) cm tall; Stem erect, simple, rarely branched, somewhat flexible, narrowly winged, light green, (2-)4-6 mm in dia. at base; internodes short, (15-)20-25(-30) mm long. Plant stoloniferous and tuber-bearing; Stolons to more than 50 cm long; Tubers white, globose to ovoid or elongated, small, 1.5-2.0 cm long (Fig. 276). Leaves light green, short and broad, (8-)11-14(-16) cm long by (5.5-)9.0-12.5(-13.0) cm wide, imparipinnate, with 2-3(-4) pairs of leaflets and without interjected leaflets, essentially glabrous to very sparsely pilose, petioles short, 10-15 mm long, with short glandular and tetralobular hairs, especially near the axils of the leaves. Terminal leaflet broadly ovate-lanceolate to elliptic-lanceolate or broadly elliptic, apex pointed or rarely obtuse, base rounded, margins entire; Terminal leaflet larger than the laterals, (3.5-)5.0-7.0(-10.5) cm long by (2.5-)3.0-4.0(-7.0) cm wide; Lateral leaflets more narrowly ovate-lanceolate, apex pointed to subobtuse, base obliquely rounded, occasionally shortly petiolulate but usually sessile and slightly decurrent about the rachis; the first pair of lateral leaflets (3.0-)5.0-6.0(-9.5) cm long by 2.5-3.0 (-5.0) cm wide. Pseudostipular leaves clasping, broadly falcate, (5-)12-16(-20) mm long by (2.5-)7.0-8.0(-14.0) mm wide. Inflorescence terminal or lateral, cymose or occasionally cymose-paniculate, 6-12-flowered; peduncle light green as in the case of the pedicels and the calyx, short, 2-3 cm long; pedicels glabrous or sparsely pilose, 20-30 mm long,, articulated near the center or slightly below or above center. Calyx symmetrical, small, 3-4 mm long; lobes broadly ovate, apex apiculate or shortly acuminate, with filiform acumens. Corolla rotate to rotate-pentagonal, 3.5 cm in dia. (Figs. 274, 275), white, with a yellowish-green internal star. Anthers orange-yellow, narrowly lanceolate, 6 mm long, slightly cordate at base; filaments about 1 mm long, white-hyalinous, greenish. Style 10-11 mm long, densely papillose along the basal two-thirds of its length; stigma subglobose, cleft or rarely bifid. Fruit round, 15-20 mm in dia., typically lime-green in color. Chromosome Number: 2n=24. EBN=1.

Local Name: *Papa de Loma*

Type: PERU. Department Lima, Province Chancay, Latillo, 150 m alt., *lomas* of Chancay, 25 August 1952, C. *Ochoa 1804* (holotype OCH).

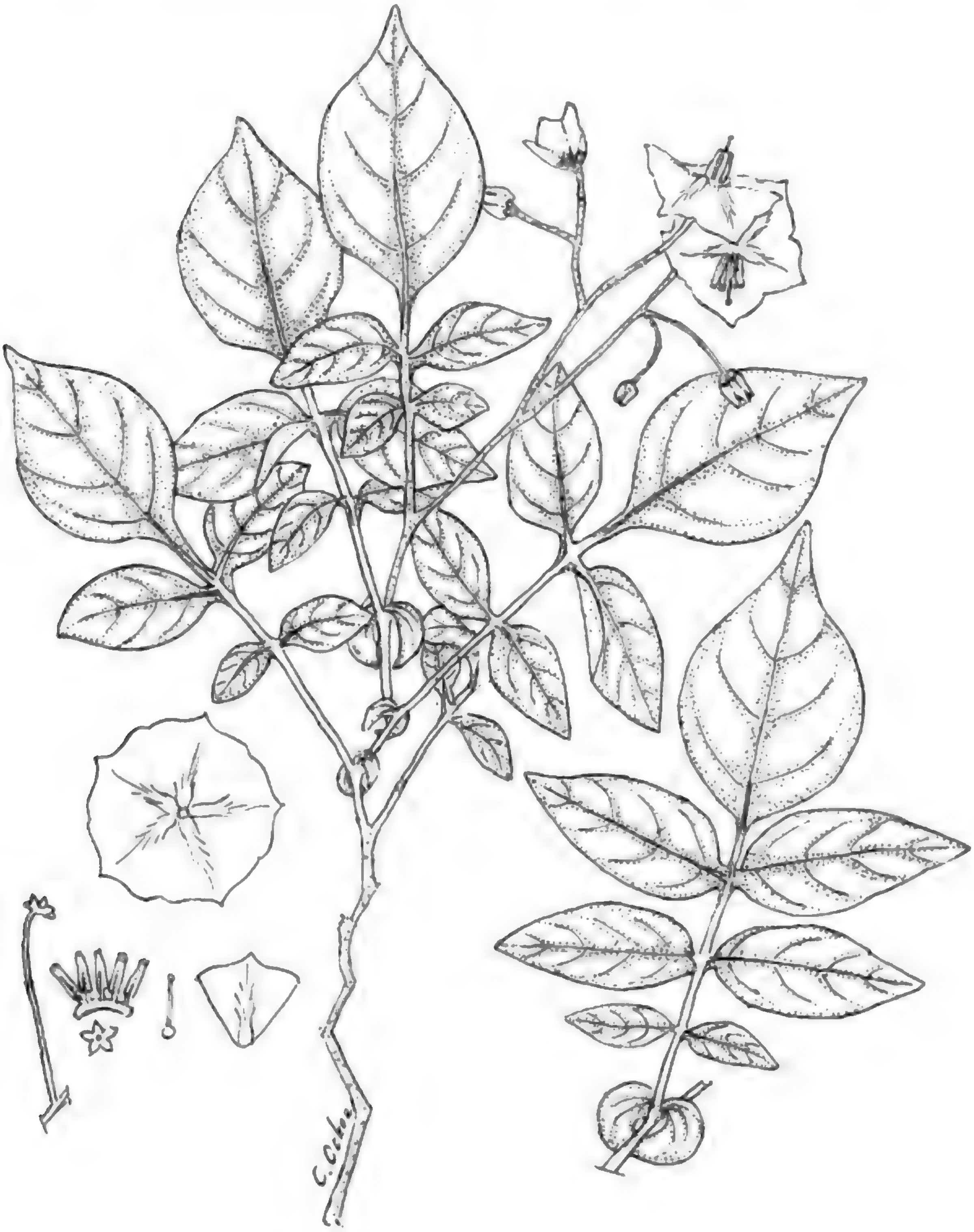


Figure 274. *Solanum chancayense* (*Ochoa 2159*, topotype).

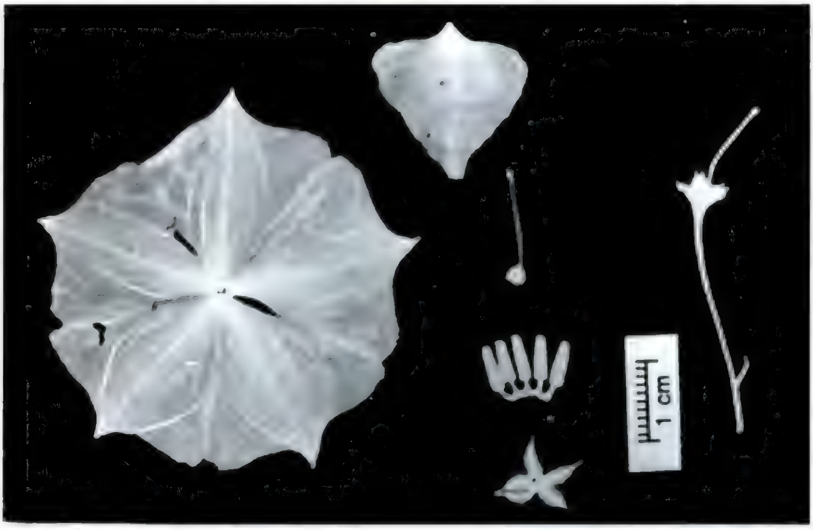


Figure 275. Floral dissection of *Solanum chancayense* (*Ochoa 11250*).

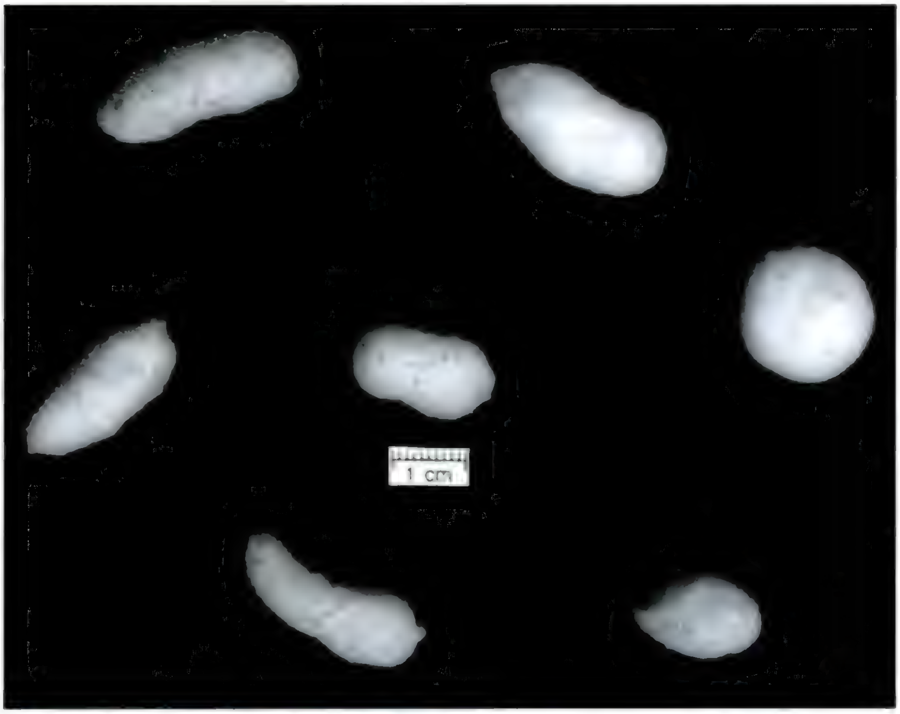


Figure 276. Tubers of *Solanum chancayense* (*Ochoa 11250*).

Affinities

As will be mentioned again under the treatment of *S. incahuasinum*, *S. chancayense* is related to *S. mochiquense*. Both species bear white flowers on pedicels that are articulated in approximately the same position, and both have calyces of approximately the same size and shape. However, the two differ substantially in the habit of the plant and in the shape and segmentation of the leaves. Plants of *S. mochiquense*, for example, are much more robust, with stems occasionally reaching nearly 1 m in length, while plants of *S. chancayense* are usually much smaller, or even dwarfed in stature. Also, the leaves of *S. mochiquense* have irregualrly crenulate or crenulate-denticulate margins and are more divided, with up to 5 pairs of leaflets and many interjected leaflets, whereas those of *S. chancayense* are entire-margined and are usually less divided, having fewer pairs of leaflets and no interjected leaflets.

Habitat and Distribution

This short-stemmed species is a member of the *loma* plant formations that develop very briefly and seasonally in the arid coastal regions of Peru during the more humid summer months. It is found in loose rocky soil on hillsides and in the quebradas of the low mountains that occur near the sea, generally at elevations that range between 150 and 550 m. Within these habitats, *S. chancayense* has been collected occasionally with *S. medians*, or under the protective spiny stems of *Loasa nitida*.

This species occurs most abundantly in the *lomas* of Lachay and Chancay north of Lima and to a lesser extent in the *lomas* of Chiputur which are located south of Trujillo in the Department of La Libertad.

Specimens Examined

Department Lima

Province Barranca: *Lomas* east of Pativilca, 200 m alt., among stones in sand, flowers white, 25 August 1971, *C. Ochoa 3040* (OCH).

Province Cañete: Corral Lomasino, 250 m alt., in the *loma* formations of Quilmaná, about 11 km north of Cañete, in rocky-sandy land, very rare, flowers white, 29 August 1952, *C. Ochoa 1809* (OCH).

Province Huaral: Latillo, 150 m alt., near the *lomas* of Chancay, in sandy-rocky soils, 25 August 1952, *C. Ochoa 1804*, $2n=24$ (OCH, type collection of *S. chancayense*). Along the route to the Baños de Churín, 200-400 m alt., near detour of Panamerican Highway in the vicinity of the *lomas* of Lachay, in sandy soil, 26 August 1952, *C. Ochoa 1806* (GH, OCH, US). *Lomas* of Chancay, 200-

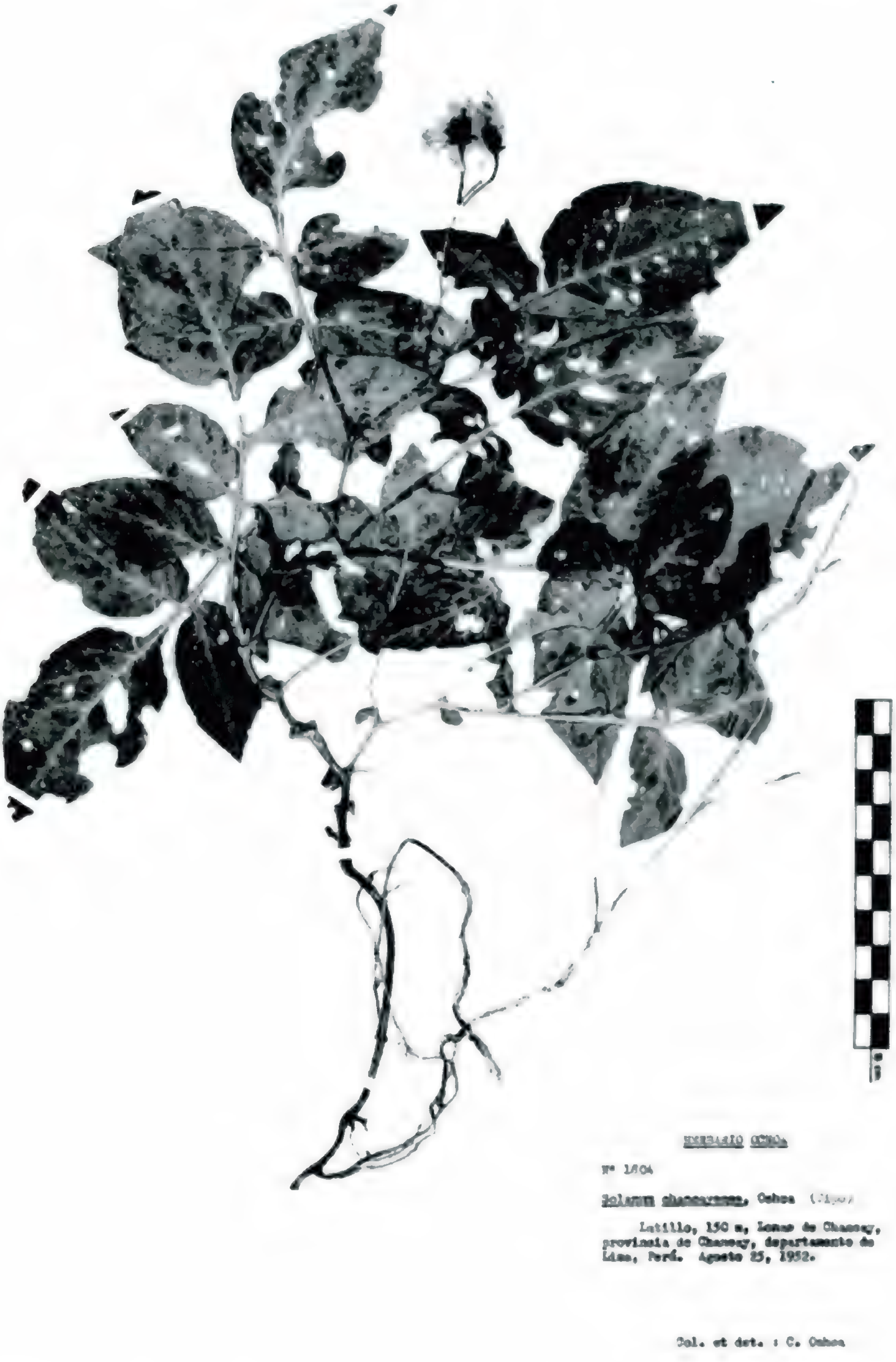

HERBARIO OCHOA
Nº 1804
Solanum chancayense, Ochoa
Latillo, 150 m, Lomas de Chancay, provincia de Chancay, departamento de Lima, Perú. Agosto 25, 1952.
Col. et det. : C. Ochoa

Figure 277. Plant of *Solanum chancayense* Ochoa (*Ochoa 1804*, holotype).

250 m alt., on a rocky hill, flowers white, 24 September 1952, *R. Ferreyra 8718a* (LL, OCH, USM). Latillo, 250 m alt., near the *lomas* of Chancay, in sandy soil, flowers white, 9 September 1958, *C. Ochoa 2159* (OCH, US, topotypes of *Solanum chancayense*). *Lomas* of Chancay, 180-200 m alt., between Lima and Huacho, in rocky soil, flowers white, 1 October 1960, *R. Ferreyra* and *P. Hjerting 14130* (LL, USM) and *14144*, in a rocky quebrada, with *Loasa nitida* (LL, OCH, USM). *Lomas* of Lachay, 200 m alt., 11 August 1971, *Z. Huamán 235* (CIP, OCH). *Lomas* of Lachay, in sandy-rocky soils, flowers white, very rare, September 1975, *C. Ochoa 10981*, 2n=24 (OCH). *Lomas* of Lachay, 250 m alt., north of Lima, growing near *S. medians, October* 1976, *C. Ochoa 11250*, 2n=24 (CIP, MOL, OCH, US). *Lomas* of Lachay, 280 m alt., about 85 km north of Lima, in sandy soil, 6 September 1977, *C. Ochoa 11765*, 2n=24 (CIP, F, GH, MOL, OCH, US, USM), and *11766*, 2n=24 (OCH, from plants grown in the greenhouse at La Molina, near Lima).

Department La Libertad

Province Trujillo: Cerro Chiputur, 550 m alt., in the *lomas* of Chiputur, 7 km south-southeast of Trujillo, 3 km east of the Panamerican Highway, 11 September 1952, *C. Ochoa 1830* (OCH) and *1831* (OCH).

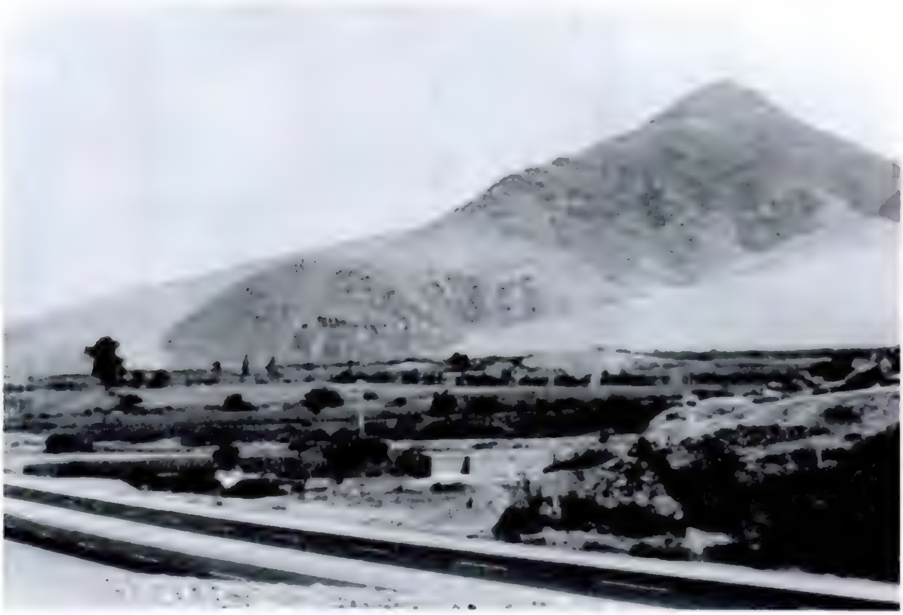


Figure 278. Cerro Latillo, about 2 km northwest of Chancay, type locality of *Solanum chancayense*, January 1988.

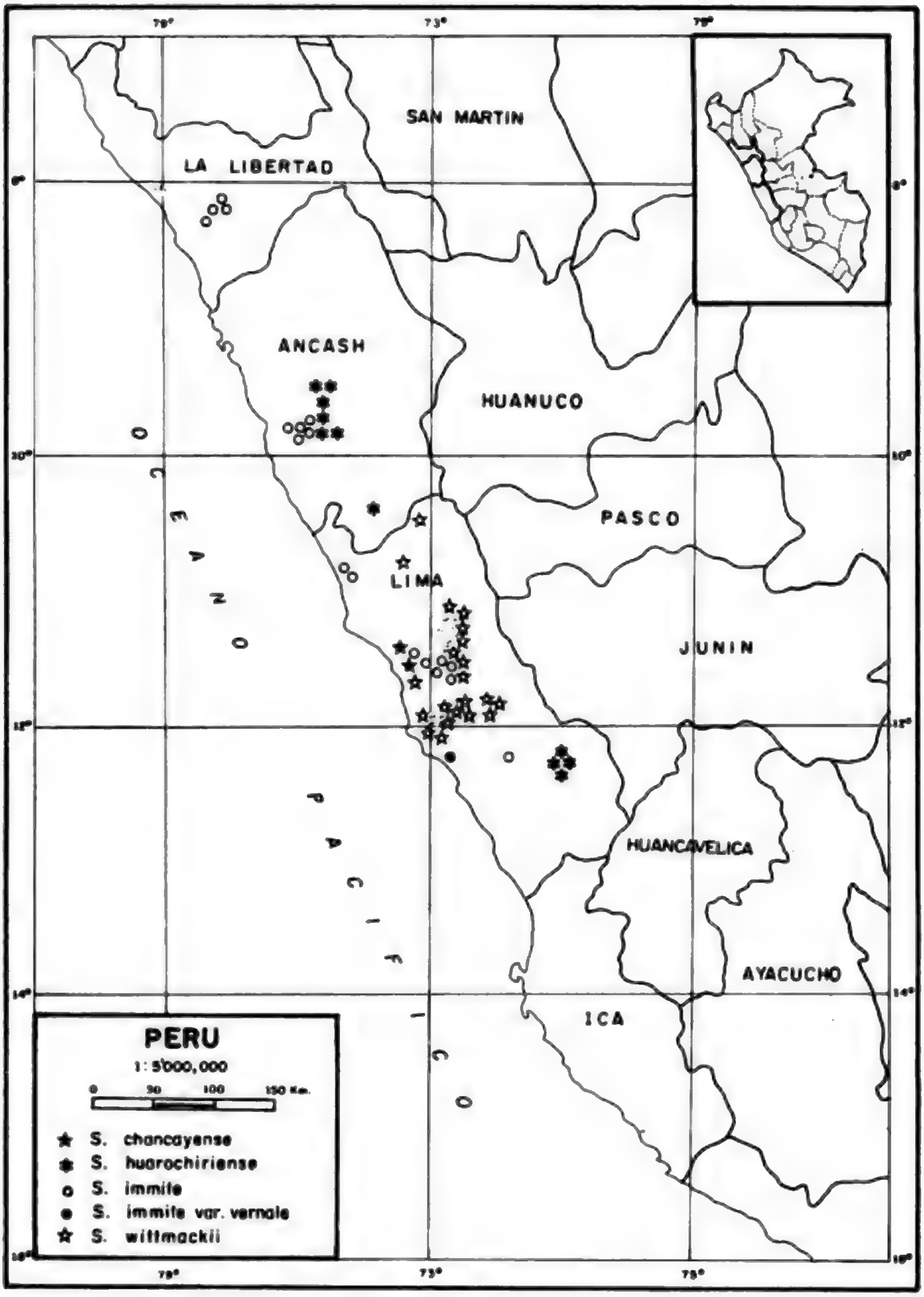
Breeding Potential

The results of crosses of *S. chancayense* with diploid (2n=24) species with EBN=1 and 2 are given in Table 68, while the field materials used for these experiments are shown in Table 69.

Like the great majority of other wild diploid species of this section, S. chancayense is a self-incompatible species.

Reciprocal crosses between *S. chancayense*, *S. incahuasinum* and *S. mochiquense* resulted in large number of seeds being produced per berry on the average. The seemingly complete lack of crossability barriers, in this case, can be attributed to the fact that all three species belong to the same taxonomic series and have identical EBN values and chromosome numbers. The fact that much fewer seeds resulted from reciprocal crosses involving *S. chancayense* and *S. immite* suggests that these two species are more distantly related to one another. However, the results of the unilateral cross made between *S. chancayense* and *S. wittmackii* would appear to implicate even a more distant relationship, as only an average of 3 seeds per berry were obtained. And lastly with respect to this first group of EBN=1 plants, it should be noted that the reciprocal crosses involving *S. chancayense* and *S. lignicaule* of Series Lignicaulia were successful only when the latter was used as the staminate parent; whereas, in the crosses involving *S. chancayense* and the species *S. hypacrarthrum* of Series Piurana, success was achieved in those cases only where the latter was used as the pistillate parent.

With respect to crosses involving EBN=2 plants and *S. chancayense*, which is EBN=1, the results are rather uneven. Reciprocal crosses between *S. chancayense* and *S.* multiinterruptum or S. chancayense and S. medians resulted in large numbers of seeds when S. *chancayense* was used as the staminate parent, and only few when it was not. On the other hand, no seed at all was obtained in reciprocal crosses involving *S. chancayense* and *S. bukasovii*, or for that matter in unilateral crosses involving *S. chancayense* and *S. × arahuayum*, *S. marinasense* or *S. phureja* (all of the Series Tuberosa). Lastly, large numbers of seeds were obtained in reciprocal crosses of this species with *S. chomatophilum* of Series Conicibaccata, but only when the latter species was used as the pistillate parent.



Map 24. Distribution of *S. chancayense*, *S. huarochiriense*, *S. immite*, *S. immite* var. *vernale* and *S. wittmackii*.

Table 68. Fertility of *Solanum chancayense* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	LIGNICAULIA	× *S. lignicaule*	7(5)	7(0)	46(0)
24	1	MEGISTACROLOBA	× *S. dolichocremastrum*	3	2	0
24	1	PIURANA	× *S. hypacrarthrum*	7(6)	3(3)	0(101)
24	1	TUBEROSA	× *S. immite*	12(10)	7(6)	19(52)
			× *S. incahuasinum*	39(32)	22(25)	136(146)
			× *S. mochiquense*	40(92)	33(58)	122(181)
			× *S. wittmackii*	14	5	3
24	2	CONICIBACCATA	× *S. chomatophilum*	21(4)	10(3)	5(200)
24	2	MEGISTACROLOBA	× *S. raphanifolium*	32	20	0
24	2	TUBEROSA	× *S.* × *arahuayum*	7	2	0
			× *S. bukasovii*	19(3)	15(0)	0(0)
			× *S. coelestispetalum*	2	1	0
			× *S. marinasense*	4	2	0
			× *S. medians-2x*	29(10)	14(2)	2(38)
			× *S. multiinterruptum*	25(7)	9(6)	3(117)
			× *S. phureja*	5	4	0

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 69. Collections (OCH) used in *Solanum chancayense* fertility studies.

CONICIBACCATA
S. chomatophilum 10728, 11754, 13203, 13205

LIGNICAULIA
S. lignicaule 11617

MEGISTACROLOBA
S. dolichocremastrum 13013
S. raphanifolium 13574, 14296, 15628, 15699

PIURANA
S. hypacrarthrum 11308, 14731

TUBEROSA
S. × *arahuayum* 13257
S. bukasovii 13121, 13195, 14333
S. chancayense 11250, 11765
S. coelestispetalum 13606
S. immite 11689, 13346, 14491
S. incahuasinum 11613
S. marinasense 15687
S. medians-2x 11884, 12044, 12047, 13185
S. mochiquense 14820, 14870
S. multiinterruptum 11314, 12057, 14524, 14696
S. phureja 13909
S. wittmackii 11877, 13267

57. *Solanum chillonanum* Ochoa, Phytologia 67(3):235, 1989. Basionym: *Solanum tenellum* Ochoa, Phytologia 63(6):455-456, illustr., 1987, not *S. tenellum* Bitter, in Fedde Repert. Spec. Nov. 11:219, 1912.

Fig. 279; Map 23.

Plant erect, somewhat rosette-forming at base, small, 15-20(-30) cm tall, light green, non-pigmented, sparsely pilose; stem slender, 3-4 mm in dia. at base, branched, very sparsely pubescent with very short white hairs and very narrowly and inconspicuously winged; internodes 0.6-1.5(-2.0) cm long. Stolons 30-40 cm long by 1-2 mm in dia.; tubers small and white, 1-2 cm long, round to oblong. Leaves pale green, delicate, fine and slender in appearance, somewhat extending and forming angular openings in the stem in the basal one-third of its length, 5.5-9.0(-11.0) cm long by 2.5-6.0(-6.5) cm wide, imparipinnate, with 4-5 pairs of leaflets and 3-6 pairs of interjected leaflets. Leaflets narrowly elliptical or lanceolate, sparsely pubescent over the entire upper surface including the rachis and petioles, but pubescent only on the veins and veinlets below. Terminal leaflet somewhat rhombic-lanceolate, usually somewhat larger than the first pair of lateral leaflets, 2-3 cm long by 0.7-1.6 cm wide, apex shortly acuminate, base long-attenuate or cuneate. The first pair of lateral leaflets equal in size to the second pair or slightly smaller, sessile, 1.4-2.5 cm long by 0.8-1.0 cm wide; the apex of the lateral leaflets obtuse or slightly pointed, obliquely rounded to obtuse at base; lateral leaflets shortly petiolulate or subsessile. Interjected leaflets small, 0.5-6.0 mm long, orbicular or elliptical, sessile. Pseudostipular leaves narrow, obliquely subelliptic, small, to 6 mm long. Inflorescence cymose, 5-7-flowered; peduncle 8 cm long by 1.0-1.5 mm in dia. at base, very sparsely pubescent; pedicels somewhat more densely pubescent than the calyx, 25-30 mm long, articulated in the upper one-third of their length or about 6-7 mm below the base of the calyx. Calyx light green, as in the case of the peduncles and pedicels, symmetrical, 7.0-7.5 mm long, lobes narrowly elliptic-lanceolate, the apex abruptly narrowing to pointed or narrowly subspatulate 2-3 mm long acumens. Corolla rotate-pentagonal, 2.5 cm in dia. (Fig. 279), white, with a yellowish-green internal star, acumens short. Anthers broadly lanceolate, 6.0-6.5 mm long by 1.8-2.0 mm wide at base; filaments very short, 0.4-0.5 mm long, white, glabrous. Style 8.5 mm long, densely papillose along the basal two-thirds of its length; stigma capitate, small, cleft. Fruit round, light green, 1.5 cm in dia. Chromosome Number: 2n=24.

Type: PERU. Department Apurímac, Province Cotabambas, near Chillo (or Quillo), 4000 m alt., between Tambobamba and Cotabambas, March 1973, *C. Ochoa 4101* (holotype OCH, isotypes CIP, US).

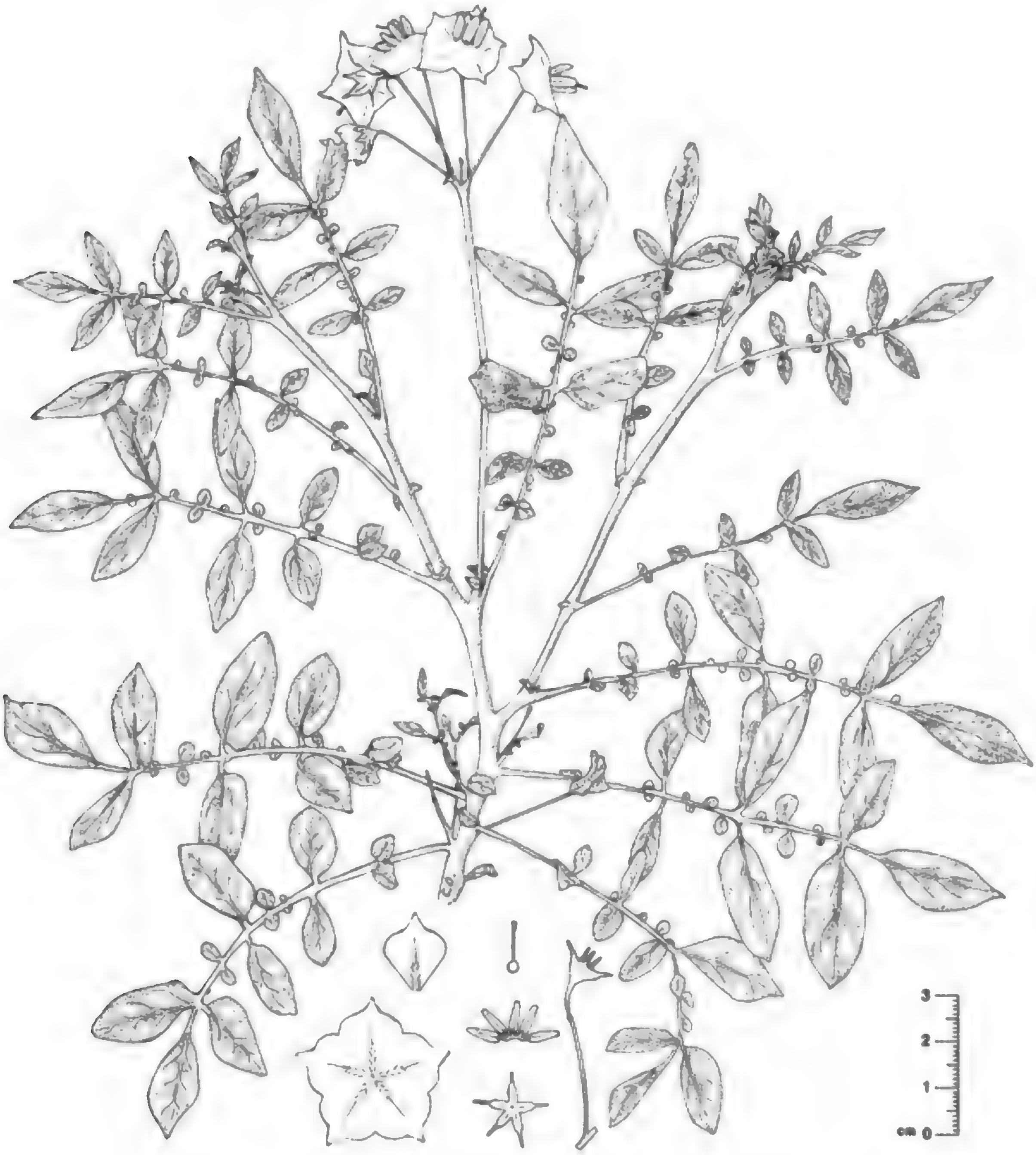


Figure 279. *Solanum chillonanum* (*Ochoa 4101*, holotype).

Although the present author originally named this species *S. tenellum*, this name had to be changed when it was learned that the taxonomist Bitter had used that specific epithet earlier for a non-tuberous Brazilian species of *Solanum*. The new name for this species, *Solanum chillonanum*, has double meaning, it alludes to both the type locality (Chillo) and the small size (*enano* or dwarfness) of this *Solanum* species. The village of Chillo, by the way, which is ordinarily called by that name by its inhabitants, is also occasionally referred to as Quillo.

Affinities

While showing some affinity to *S. gracilfrons*, this species is more closely related to *S. bukasovii* than to any other wild tuberous *Solanum* species. The two share several important features in common, including the shape and dissection of the leaves and the small, rosette-like habit of the plant. Moreover, both grow preferentially in the high mountains or puna regions of southern Peru, where small-stemmed rosette-forming ecotypes of *S. bukasovii* are not of uncommon occurrence.

Habitat and Distribution

This species is found in the high, cool puna regions of Peru, where it grows in steppe grassland or on gentle, grass-covered slopes among tufts of *Stipa ichu* and plants of the genus *Astragalus* and *Urtica*. Currently, this species is known only from the *punas* of Chillo and Aquillani in the Province of Cotabambas, Department of Apurímac, in southern Peru (Map 23).

Specimens Examined

Department Apurímac

Province Cotabambas: Near Chillo (or Quillo), 4000 m alt., *puna* between Tambobamba and Cotabambas, flowers white, March 1973, C. *Ochoa 4101* (OCH, CIP, US, type collection of *S. chillonanum*). *Punas* of Aquillani, 4100 m alt., along the route Tambobamba to Cotabambas, flowers white, 1 March 1980, C. *Ochoa 13683*, 2n=24 (CIP, MOL, OCH, USM, from plants propagated in the greenhouse at Huancayo).

58. *Solanum coelestispetalum* Vargas, in *Las Papas Sudperuanas*, Univ. Nac. Cusco 2:59, illustr., Fig. 15, 1956.

Figs. 280-285; Map 23; Plate XXVI.

Plant erect to erect-ascending, (30-)50-70 cm tall, pubescent; stem simple or little-branched, slightly pigmented in the basal one-third of its length and in the leaf axils, sparsely pilose, narrowly straight winged; internodes 3-6 cm long. Stolons up to 1.50 m long; tubers white, round, pyriform to ovoid, small, 1-2 cm long. Leaves (8.5-)13.0-20.0(-24.5) cm long by (5.8-)9.5-12.0(-17.5) cm wide, densely pubescent, including the upper side of the rachis and petioles, hairs brilliant-white, finely velvety and much more pubescent below, imparipinnate with 3-4(-5) pairs of lateral leaflets and 3-6(-8) pairs of interjected leaflets. Leaflets ovate or broadly ovate to ovate-lanceolate, apex slightly pointed, base oblique and broadly rounded or occasionally cordate or subcordate; petiolules 2-4 (-6) mm long. Terminal leaflet slightly larger than the first and second upper pairs of laterals, (4.5-)6.0-8.0 cm long by (3.0-)3.5-4.0 cm wide; first upper pair of leaflets (3.0-)5.0-7.5 cm long by (1.4-)2.5-3.5 cm wide. Interjected leaflets orbicular or broadly elliptical, sessile, unequally 1-15 mm long. Pseudostipular leaves shortly stipulate, broadly falcate, 7-15 mm long by 4-9 mm wide. Inflorescence cymose or cymose-paniculate, terminal or lateral, (7-)15-25-flowered; peduncle (4-)7-10 cm long, densely puberulent as in the case of the pedicels, forked one or two times; pedicels 15-20(-25) mm long, articulated in the upper one-third of their length or about 5-7 mm below the base of the calyx. Calyx symmetrical or asymmetrical, pilose, slightly pigmented at base and along the veinlets, 8-10 mm long; lobes ovate-lanceolate or rectangular-lanceolate, subquadrate, abruptly acuminate, acumens subspatulate, 3-4 mm long. Corolla rotate (Figs. 281, 282), sky-blue or violet, 3.0-3.5(-4.0) cm in dia., with a yellow internal star, densely puberulent. Anthers lanceolate, 5.0-5.5 mm long; filaments 1.5 mm long, glabrous. Style 8-10 mm long, exerted 2-3 mm, densely papillose along the basal two-thirds of its length; stigma capitate or subglobose, cleft. Fruit globose, large, 2.5-3.5 cm in dia, light green with small white spots and vertical deep-violet stripes (Fig. 283). Chromosome Number: 2n=24. EBN=2.

Type: PERU. Department Cusco, Province Urubamba, Salapunco, 2400 m alt., at km 84 of the Cusco-Santa Ana Railroad, among trees, 25 March 1946, *C. Vargas C. 5990* (lectotype CUZ, here designated; isotypes LL, OCH).

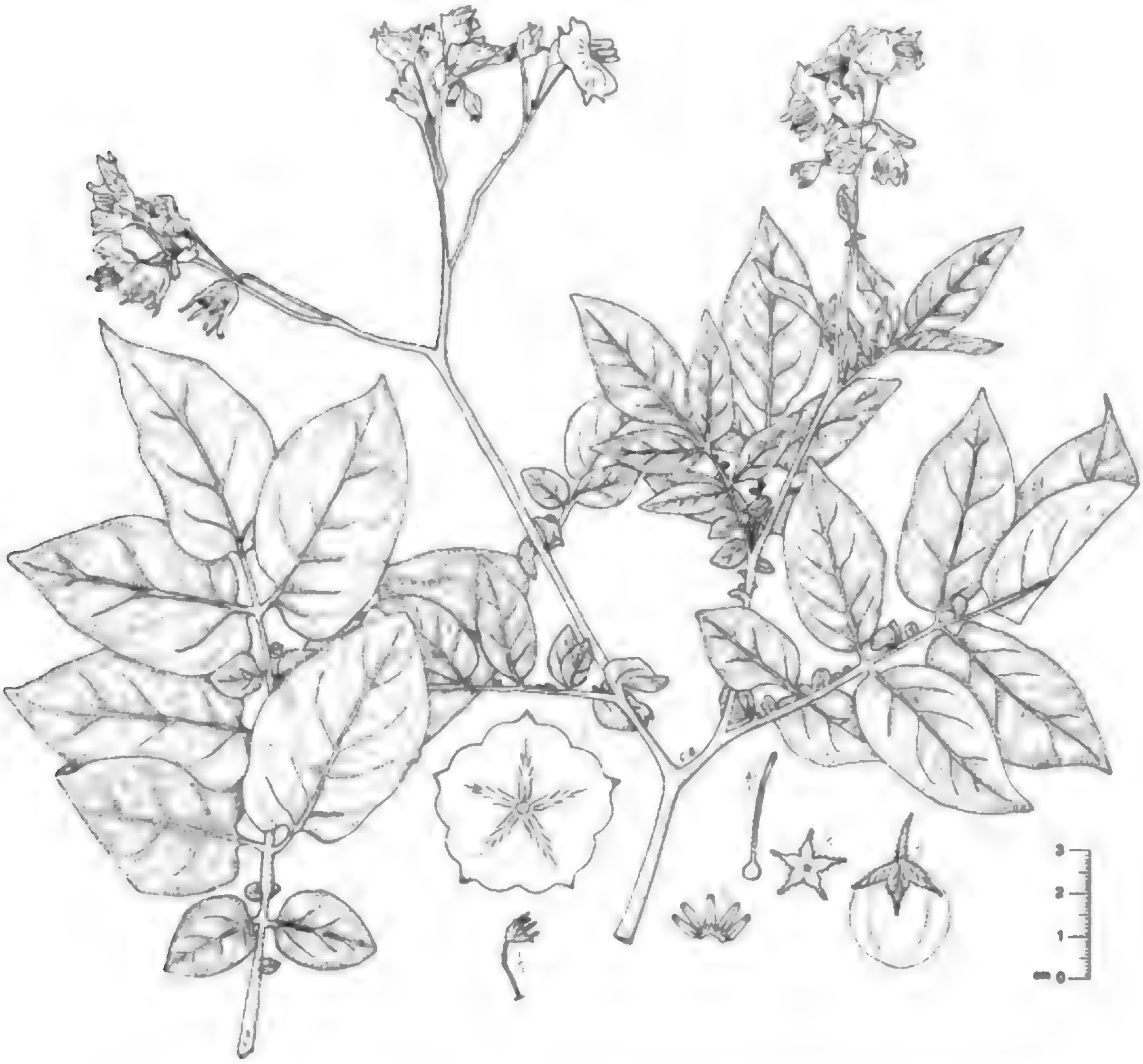


Figure 280. *Solanum coelestispetalum* (*Vargas 5990*, lectotype CUZ).

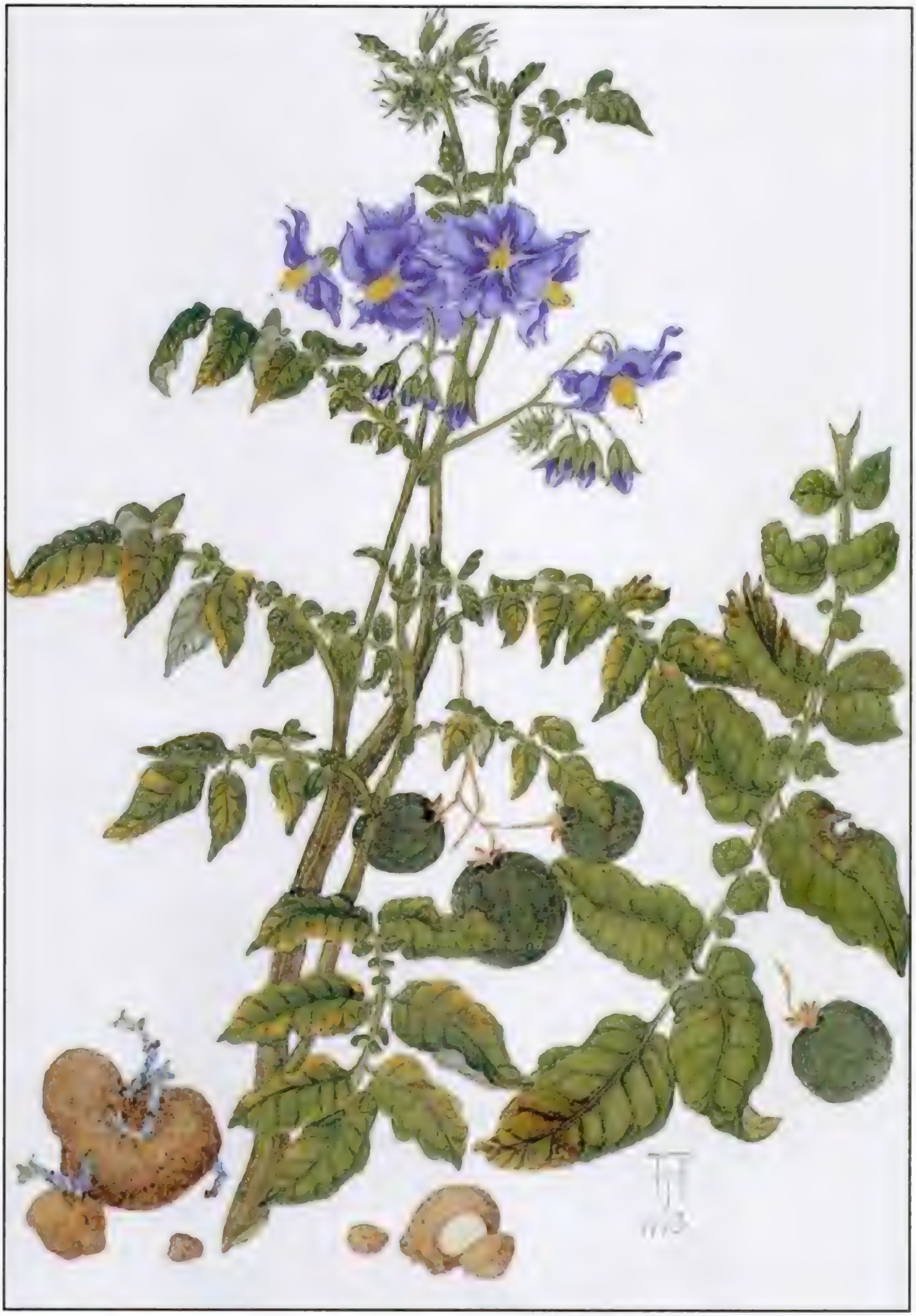


Plate XXVI. *Solanum coelestispetalum* Vargas.

Affinities

This species has a number of characteristics in common with *S. ambosinum*, including leaf dissection and the overall shape of the leaflets, which, in both species, varies from oval or oval-elliptic to broadly elliptic, and from obtusely-tipped to slightly pointed. However, *S. coelestispetalum* differs from that species in having leaflets that are more densely and finely silky above and more densely puberulent or velvety below. Also, the position of the pedicel articulation in *S. coelestispetalum* is much higher up than in *S. ambosinum*. Moreover, this species has rectangular-lanceolate calyx lobes with subspatulate acumens, blue or pale violet flowers and large, nearly globose fruits.

Although probably closely related to *S. ambosinum*, this species also shares some characteristics with *S. incasicum* and *S. bukasovii*. It is similar to *S. incasicum* in the high position of the pedicel articulation and in having the entire plant covered with hairs. However, the density of the pubescence is not as great in *S. incasicum* as it is in *S. coelestispetalum*. Moreover, *S. coelestispetalum* differs from *S. incasicum* in leaflet shape and corolla size and color, and by having nearly round fruits. This species also bears a resemblance to certain well developed ecotypes of *S. bukasovii*, but, as in the case of *S. incasicum*, there are many important features that set these two species apart.

Lastly, it should be noted that the above species are closely related to one another genetically. Crosses between *S. coelestispetalum* and *S. ambosinum*, *S. incasicum*, *S. bukasovii* and *S. bukasovii* var. *multidissectum* are easily accomplished. These yield appreciable numbers of seeds per berry, on the average.

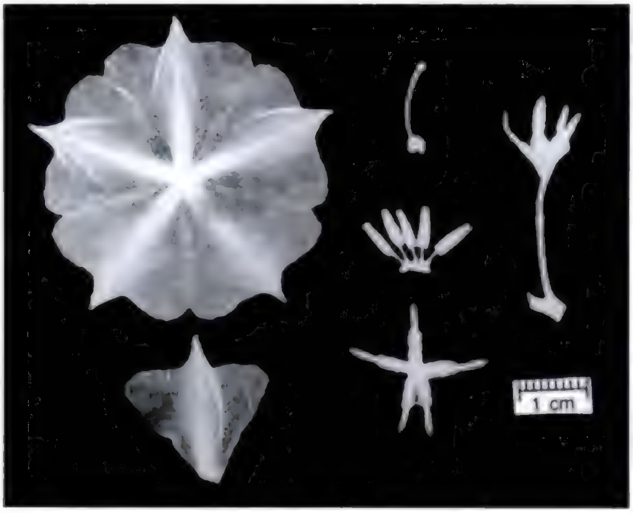


Figure 281. Floral dissection of *Solanum coelestispetalum* (*Ochoa 15664*, topotype).

Habitat and Distribution

This species appears to be equally at home in the temperate, medium elevation (2200-2950 m) interandean valleys of Peru as it is in the cool, high (up to 3900 m alt.) *puna* regions of the central Andes. As could very well be expected from a species of such wide climatic tolerance, *S. coelestispetalum* thrives under a variety of habitat conditions. It occurs, for example, either alone or with *Solanum bukasovii*, *S. sparsipilum* or *S. velardei* on rocky slopes in thicket formations comprised of various species of grasses and ferns, as well as shrubs of the genus *Cassia*, *Bacharis*, *Eupatorium*, *Lantana*, *Nicotiana*, *Salvia*, *Calceolaria* and *Urtica*; while in the drier, or more xerophytic portions of its range it is found with *Opuntia ficus-indica* and various species of columnar cacti, *Bromelia*, *Pitcairnia*, *Stenomesson*, *Bomarea*, *Ipomoea* and woody shrubs or small trees, such as *Schinus molle* and *Escallonia resinosa*. It has also been collected from quebradas and mountain slopes at elevations between 3000 and 3400 m. However, of the 60 collections of this species that were included in the present study, 24 were from the *puna* or *prepuna* areas of the high mountain districts, and were collected at elevations ranging between 3500 and 3900 m.

At present, this species is known only from the Provinces of Abancay, Andahuaylas, Antabamba and Cotabambas of the Department of Apurímac, and the Provinces of Anta, La Convención and Urubamba of the Department of Cusco (Map 23).

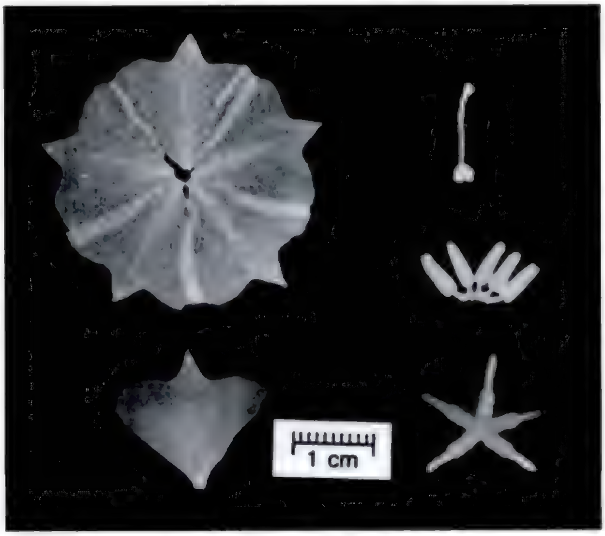


Figure 282. Floral dissection of *Solanum coelestispetalum* (*Ochoa 15667*, topotype).

Specimens Examined

Department Apurímac

Province Abancay: On rocky foothills of a mountain, facing Lambrama, 3200 m alt., 20 February 1960, C. *Ochoa 2217* (OCH). About 10 km north of Cachora, 2350-2500 m alt., going by horseback along the lower slopes of Cachora to Incahuasi, in thickets of herbs and shrubs, abundant, 20 February 1960, C. *Ochoa 2260* (OCH). Near Incahuasi, 2450 m alt., along the road to Tambobamba, in thickets of herbs and shrubs, 16 February 1960, C. *Ochoa 2262* (OCH). Vicinity of Cachora, 2550 m alt., among large colonies of *Calceolaria* and *Salvia* and many herbaceous ferns, 20 February 1960, C. *Ochoa 2263* (OCH). Near Pachapujio, 2200 m alt., between Ticabamba and Tambobamba, 18 February 1960, C. *Ochoa 2265* (OCH). Cuchicorral, 2600 m alt., near Cachora, on both sides of the Cachora-Tambobamba railroad line, 20 February 1960, C. *Ochoa 2266* (OCH). Cerro Marccancay, facing Cachora, 2700 m alt., growing near *S. velardei*, 10 April 1962, C. *Ochoa 2413* (OCH). Saracurpa, 2900 m alt., between Cachora and Incahuasi, April 1975, C. *Ochoa 7710*, 2n=24 (CIP, MOL, OCH, US, USM). Saracurpa, 3000 m alt., 7 km north of Cachora, along the railroad line to Incahuasi, berries ovoid, light green with vertical deep violet stripes, plants very susceptible to *Phytophthora infestans*, 21 April 1975, C. *Ochoa 7711*, 2n=24 (CIP, MOL, OCH). District Huanipaca, between Ccorimarca and Liwirco, 3300 m alt., April 1975, C. *Ochoa 7728*, 2n=24 (CIP, MOL, OCH). Maranpata, 3000 m alt., heading up the trail along the left bank of the Apurímac River, near Cachora, toward the ruins of Chocke Quirao, in dense thickets, 9 February 1980, C. *Ochoa 13594-A* (CIP, OCH). Steep flanks of Tamburco, 3580

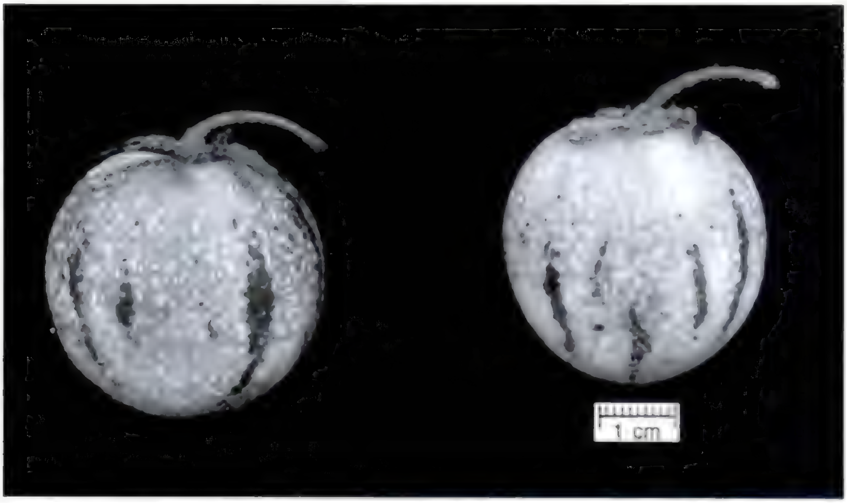


Figure 283. Fruits of *Solanum coelestispetalum* (*Ochoa 15666*, topotype).

m alt., in high mountains, between Tambobamba and Huanipaca, in tree forests of *Escallonia* and large colonies of *Lupinus* sp., corolla sky blue, large, leaves pubescent, 9 February 1980, C. *Ochoa 13603* (CIP, OCH). Between Tambobamba and Huanipaca, 3000 m alt., plants vigorous very pubescent, stems broadly winged, flowers violet, calyx long-acuminate, February 1980, C. *Ochoa 13604* (CIP, MOL, OCH) and *13605*, 2n=24 (CIP, MOL, OCH, from plants grown at the Huancayo Experimental Station). On high steep slopes, between Liwirco and Huanipaca, ca. 3600 m alt., plants vigorous more than 1 m tall, leaves pubescent, flowers sky-blue, February 1980, C. *Ochoa 13606* (CIP, OCH) and *13607* (CIP, MOL, OCH). Highlands east of Tambobamba, 3550 m alt., plants scarcely 50 cm tall, among trees of *Escallonia* sp., herbs such as *Oxalis and Urtica*, and grasses such as *Festuca, Stipa* and *Poa*, 23 March 1980, C. *Ochoa 13805* (CIP, OCH) and *13806* (CIP, OCH). Llaullipata, 2850 m alt., heading up to Pacaipampa and Huayracalle Gorge, along the trail to Cachora, 19 March 1981, C. *Ochoa 14341* (CIP, MOL, OCH). Yanamachay, 2950 m alt., between Pacaipampa and Huayracalle Gorge, along the trail to Cachora, 19 March 1981, C. *Ochoa 14342*, 2n=24 (CIP, MO, MOL, OCH, US).

Province Andahuaylas: Aya Ucroc, facing Chincheros, 2900 m alt., along the route from Andahuaylas to the Pampas River, 15 March 1967, C. *Ochoa 2622* (OCH). Vicinity of the Pacucha Lagoon, 2900 m alt, very rare, March 1981, C. *Ochoa 14336* (OCH).

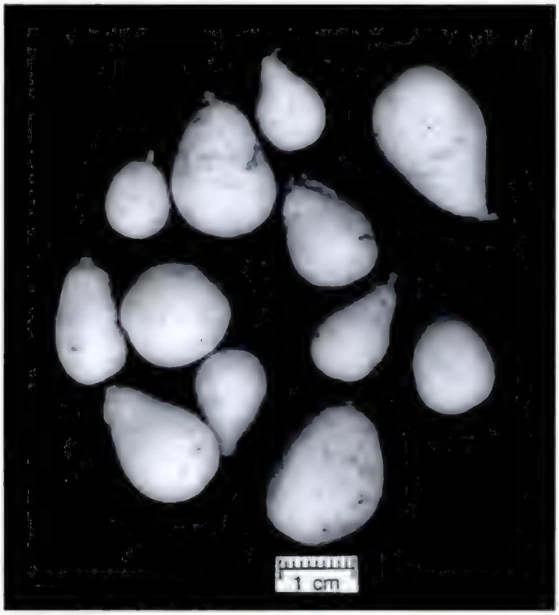


Figure 284. Tubers of *Solanum coelestispetalum* (*Ochoa 13597*).

Province Antabamba: Champapata, 2900 m alt., near Matara, heading down towards the Antabamba River, very rare, 25 March 1972, C. *Ochoa 3286*, 2n=24 (OCH).

Province Cotabambas: Cole-Colesniyocc, 3600 m alt., about 5-6 km above the river from Tambobamba, 29 February 1980, C. *Ochoa 13674*, 2n=24 (CIP, MOL, OCH, US). Near Huarcuy, 3000 m alt., about 7 km south of Cotabambas along the horse trail toward Coyllurqui, 1 March 1980, C. *Ochoa 13686* (CIP, MO, MOL, OCH, US).

Department Cusco

Province Anta: Limatambo-Cunyacc, 2000-2300 m alt., on hillsides and among herbs, 15 March 1963, C. *Vargas* C. *14308* (CUZ, OCH, WIS). Mollepata, 2650 m alt., 12 January 1967, C. *Vargas* C. *019591* (CUZ, OCH). Congapata, 3300 m alt., traveling along the Cusco-Abancay road via the Willkipata Gorge to Limatambo, 7 February 1980, C. *Ochoa 13609*, 2n=24 (CIP, GH, MO, MOL, OCH, US, USM). Huacahuaylla, 3600 m alt., between Chinchaypujio and Anta, abundant, plants more than 2 m tall, flowers sky-blue, berries globose, light green, March 1980, C. *Ochoa 13687*, 2n=24 (CIP, GH, MO, MOL, OCH, US, USM). Heading up from Chinchaypujio to Anta, 3600 m alt., plants to 2 m tall, flowers sky-blue with white acumens, March 1980, C. *Ochoa 13690* (CIP, OCH, USM). Tojra, 3700 m alt., near Anta Gorge, along the Cotabambas-Cusco road, via Chinchaypujio, March 1980, C. *Ochoa 13693* (CIP, MO, MOL, OCH, US, USM). Ccalayhua, 3500 m alt., heading down from Ucra toward Chinchaypujio, in thickets of shrubs and herbs, *Cassia*, *Baccharis*, *Sonchus*, *Bidens*, *Astragalus*, *Verbena* and *Poa*, plants up to 2 m tall, corolla blue-lilac with whitish acumens, 11 March 1980, C. *Ochoa 13716* (CIP, GH, MO, MOL, OCH, US, USM) and *13717* (CIP, GH, MO, MOL, OCH, US, USM). Near Willkipata Gorge, 3800 m alt., along the Zurite-Limatambo road, scarce, berries globose to ovoid, green with 1-2 vertical violet stripes, 23 March 1980, C. *Ochoa 13801* (CIP, MO, MOL, OCH, US). 1 km above the Village of Mollepata, 3300 m alt., within old stone enclosures and in clay, 23 March 1980, C. *Ochoa 13802*, 2n=24 (CIP, MOL, OCH, USM). Pampaconga, 3120 m alt., above Limatambo along the Willkipata-Anta road, in full flower on steep talus slopes and on rocks, flowers light blue with white acumens, among shrubs of *Cassia, Eupatorium* and *Calceolaria* and colonies of *Stenomesson*, 3 March 1982, C. *Ochoa 14319* (CIP, OCH, US). Near Limatambo, 2250 m alt., along the Limatambo-Mollepata road, on hillsides amid cleavage rocks and in the poor soils of a subxerophytic region, in full flower, corolla sky blue, associated with trees of *Schinus molle*, shrubs of *Fourcroya*, *Lantana* and *Nicotiana*, among colonies of *Opuntia tuna* and other columnar cacti and herbs such as *Commelina*, *Oxalis*, *Ipomoea and*

Bomarea, 16 March 1981, *C. Ochoa 14324* (CIP, OCH) and *14325* (CIP, OCH, USM). Along the ascent to Mollepata, 2760 m alt., in dense thickets of spiny shrubs, 16 March 1981, *C. Ochoa 14326*, 2n=24 (CIP, OCH, US, USM).

Province La Convención: Steep mountain sides northwest of the archaeological ruins of Chocke Quirao, 3500 m alt., among forest shrubs and some orchids (*Masdevalia* sp.) and bromeliads, flowers violet, leaves pubescent, 7 February 1980, *C. Ochoa 13596*, 2n=24 (CIP, MOL, OCH) and *13597* (CIP, MOL, OCH, US). District Vilcabamba, Uqui Corral, 3700 m alt., on the lower slopes of Cerro San Cristóbal, in moist soil, Hacienda Negrilla, foggy zone, very moist, among large rocks covered with mosses and trees of *Sambucus* sp., growing with *Calceolaria*, 16 March 1984, *C. Ochoa 15642*, 2n=24 (CIP, MOL, fragments), and *15643*, 2n=24 (CIP, MO, MOL, US, USM).

Province Urubamba: Salapunco, 2400 m alt., at km 84 of the Cusco-Santa Ana Central Railroad line, among trees, 25 March 1946, *C. Vargas C. 5990* (CUZ, LL, OCH, type collection of *S. coelestispetalum*). On an open bank near km 85 of the railroad line connecting Cusco and Machu Pikchu, plants large, near 75 cm tall, leaves dark green above, pale green below, flowers dark purple, rotate, tubers not found, 3 March 1958, *D.S. Correll and E.E. Smith P259* (US) and *P259* sheet 1 and sheet 2 (LL). Salapunco, 2450 m alt., at km 84 of the Cusco-Machu Pikchu-Santa Ana Central Railroad line, March 1968, *C. Ochoa*

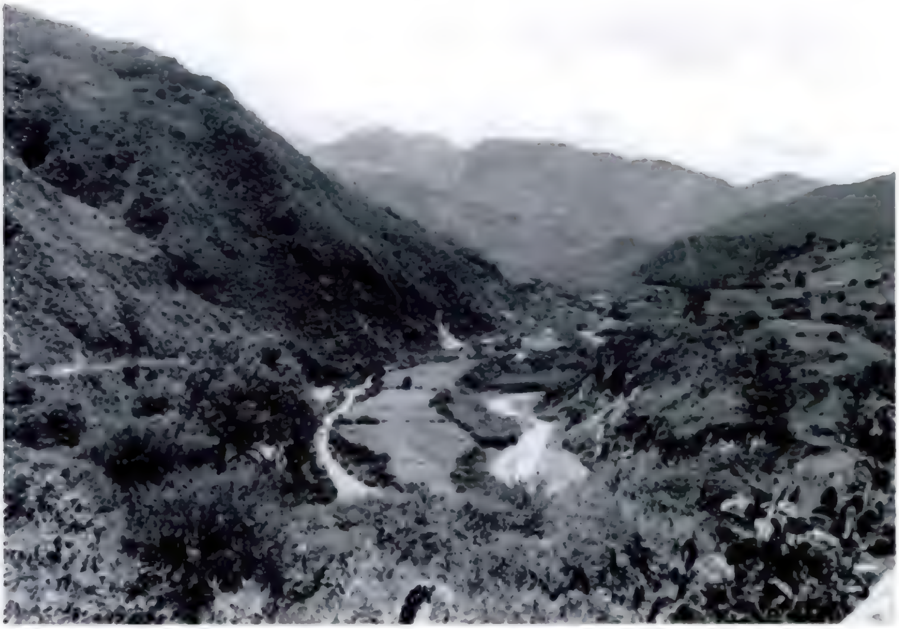


Figure 285. Habitat of *Solanum coelestispetalum*, along the trail leading down from Ckosñiriti and Peñas to Ollantaytambo, Cusco.

2675 (CIP, OCH, topotypes) and *2676* (OCH, topotype). Hacienda Negrilla, 3500 m alt., near Vilcabamba, April 1975 O. *Blanco s.n.* (OCH). Between Ccorihuayrachina and Torontoy, 2520 m alt., along the route of the Central Railroad line from Cusco to Santa Ana, growing in a cornfield near S. *sparsipilum*, 5 February 1980, C. *Ochoa 13591*, 2n=24 (OCH). Above Llulluchayocc, 3000 m alt., heading up to Wuarmiwuañusca, in shrub thickets and forests of *Escallonia resinosa*, 19-21 February 1980, C. *Ochoa 13630* (CIP, MO, MOL, OCH, US, USM). Near the ruins of Runcu Rackay, 3700 m alt., in *Stipa* grasslands, under an *Escallonia* sp. tree, berries globose, green with a few sparsely distributed white dots and vertical violet stripes, 19-21 February 1980, C. *Ochoa 13632*, 2n=24 (CIP, MO, MOL, OCH, US, USM). Highlands of Ccorihuayrachina, western side, 3450 m alt., 6 January 1981, R. *Zachmann s.n.* (OCH). Llulluchayocc, 3000-3100 m alt., above Torontoy, 19-29 March 1981, C. *Ochoa 14345* (CIP, OCH). Colesmocco, 3000 m alt., near Llulluchayocc, near and above Torontoy, 19-21 March 1981, C. *Ochoa 14347* (OCH). Steep hillsides above Torontoy, 2900 m alt., along the route of the Cusco-Santa Ana railway, 19-21 March 1981, C. *Ochoa 14348*, 2n=24 (CIP, MOL, OCH). Ñustta Jispanan, 2700 m alt., above the ruin complex of Machu Pikchu, 19-21 March 1981, C. *Ochoa 14349*, 2n=24 (CIP, MO, MOL, OCH, US, USM). Ckenti, 2400 m alt., near and to the eastern side of Ccorihuayrachina, canyon of the Urubamba, before Torontoy, berries globose to ovoid, 19-21 March 1981, C. *Ochoa 14350* (CIP, MO, MOL, OCH, US, USM). At km 83, 2450 m alt., on talus slopes of the Cusco-Quillabamba Central Railroad, berries round, 19-21 March 1981, C. *Ochoa 14351*, 2n=24 (CIP, GH, MO, MOL, OCH, US, USM). Pachar, 2900 m alt., near the Cusco-Ollantaytambo highway, among trees of *Schinus molle* and colonies of columnar cacti, in poor rocky soil, 14 March 1984, C. *Ochoa 15641*, 2n=24 (CIP, MO, MOL, OCH). Salapunco and near Salapunco, between km 83 and 84 of the Central Railroad line between Cusco and Santa Ana, 2400-2450 m alt., on talus slopes in gravel, in thickets of herbs and shrubs, 25 March 1984, C. *Ochoa 15664* (CIP, OCH, USM, topotypes), *15665* (CIP, OCH, topotypes), *15666*, 2n=24 (CIP, GH, MO, MOL, OCH, US, USM, topotypes), and *15667* (CIP, GH, MOL, OCH, US, USM, topotypes).

Breeding Potential

The results of crosses of S. *coelestispetalum* (2n=24 and EBN=2) with other diploid species having an EBN of either 1 or 2 are given in Table 70, while the field materials used for these experiments are given in Table 71.

Reciprocal crosses of S. *coelestispetalum* with S. *dolichocremastrum* (EBN=1) of the Series Megistacroloba were only partially successful, yielding few seeds and then only when *S. coelestispetalum* was used as the staminate parent. Unilateral crosses of *S. coelestispetalum* with *S. immite*, also EBN=1 but of the Series Tuberosa, were completely unsuccessful.

With respect to crosses involving species of Series Tuberosa that have an EBN value of 2, large numbers of seeds were obtained in reciprocal crosses between *S. coelestispetalum* and *S. aymaraesense*, *S. bukasovii*, *S. bukasovii* f. *multidissectum*, *S. goniocalyx*, *S. marinasense*, *S. orophilum*, *S. raphanifolium*, *S. sawyeri*, *S. sparsipilum* and *S. velardei*. Similar success was had in unilateral crosses involving *S. huarochiriense*, *S. incasicum* and *S. phureja*. However, reciprocal crosses of this species with *S. huancabambense*, *S. medians-2x* and *S. medians-3x*, though of the same series as *S. coelestispetalum*, failed completely.

Excellent seed set was obtained in reciprocal crosses of *S. coelestispetalum* with such diploid, EBN=2 members of the Series Conicibaccata as *S. laxissimum*, *S. santolallae*, *S. urubambae* and *S. urubambae* f. *velutinum*. On the other hand, no seed at all was obtained in unilateral crosses involving *S. coelestispetalum* and *S. chiquidenum* (2n=24 and EBN=2) of Series Piurana.

Table 70. Fertility of *Solanum coelestispetalum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	MEGISTACROLOBA	× *S. dolichocremastrum*	9(9)	0(6)	0(8)
24	1	TUBEROSA	× *S. immite*	8	8	0
24	2	CONICIBACCATA	× *S. laxissimum*	17(1)	9(1)	57(300)
			× *S. urubambae*	14(65)	11(39)	97(40)
			× *S. urubambae* f. *velutinum*	11(25)	6(19)	67(98)
24	2	MEGISTACROLOBA	× *S. raphanifolium*	42(15)	21(7)	39(21)
24	2	PIURANA	× *S. chiquidenum*	13	11	0
24	2	TUBEROSA	× *S. aymaraesense*	6(35)	4(22)	63(59)
			× *S. bukasovii*	169(120)	131(81)	225(195
			× *S. bukasovii* f. *multidissectum*	30(42)	28(34)	159(154)
			× *S. goniocalyx*	15(14)	5(9)	156(48)
			× *S. huancabambense*	13(0)	0(0)	0(0)
			× *S. huarochiriense*	15	10	20
			× *S. incasicum*	12	9	167
			× *S. marinasense*	119(70)	89(63)	140(185)

× *S. medians*-2x	8(2)	0(1)	0(0)
× *S. medians*-3x	8(10	0(10)	0(0)
× *S. orophilum*	120(158)	91(104)	178(236)
× *S. phureja*	6	6	77
× *S. sawyeri*	5(15)	1(5)	100(63)
× *S. sparsipilum*	10(41)	5(33)	39(70)
× *S. velardei*	24(10)	13(6)	232(100)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 71. Materials (OCH) used in crossability studies of *Solanum coelestispetalum*.

CONICIBACCATA
S. laxissimum 11855, 13189, 13640, 13706
S. urubambae 13779, 13779A, 13781, 15638, 15650, 15657
S. urubambae f. *velutinum* 13780, 13783

MEGISTACROLOBA
S. dolichocremastrum 12074, 13013
S. raphanifolium 13705, 13721, 13735

PIURANA
S. chiquidenum 11059

TUBEROSA
S. aymarasense 13810
S. bukasovii 7715, 8693, 11295, 11301, 11306, 11851, 11859, 11876, 13115, 13168, 13188,13190, 13543, 13582, 13672, 13680, 13692, 1370713713, 13715, 13729, 13730, 1379813799, 13859, 13862, 14381, 14383, 15692
S. bukasovii f. *multidissectum* 11868, 13548, 13581, 13720
S. coelestispetalum 7710, 7711, 7728, 13591, 13597, 13604, 13605, 13607, 13609, 13632, 13674, 13686, 13687, 13690, 13693, 13716, 13717, 13801, 13802, 14326, 14341, 14347, 14349, 14350, 15666, 15667
S. goniocalyx 00001
S. huancabambense 11627, 14815
S. huarochiriense 11331
S. immite 11689
S. incasicum 13631
S. marinasense 13609, 13673, 13675, 13698, 13722, 13737, 13738, 13740, 13749A, 13808, 13809
S. medians-2x 14908
S. medians-3x 12044, 13185
S. orophilum 12077, 12078, 12079, 12080, 12082, 12095, 13003, 13011, 13021, 13323

S. phureja 9628, 13901
S. sawyeri 13698
S. sparsipilum 11893, 13588, 13644, 13786
S. velardei 13688

59. ***Solanum gracilifrons*** Bitt., Beibl. Bot. Jahrb. No. 119, 54:6-7, 1916.

Figs. 286-289; Map 25; Plate XXVII.

Plant erect, 15-30(-50) cm tall, glabrous; stem simple or little-branched, woody or slightly woody, cylindrical, with inconspicuous, short and very narrow decurrent lines, slender, 3-5 mm in dia. at base, slightly flexuous, glabrous, light green in the upper portions and densely spotted with light brown pigment along the basal two-thirds of its length; internodes (1.5-)2.0-3.5(-5.0) cm long. Stolons up to 80 cm long, slender, 1.0-1.5 mm in dia., white; tubers small, 1.5-2.5 cm long, round to ovoid, white (Fig. 289). Leaves 9.5-11.5 cm long by 5.0-7.5 cm wide, imparipinnate, with (6-)7-8(-9) pairs of leaflets and (4-)7-10(-15) pairs of interjected leaflets. Leaflets narrowly lanceolate, apex pointed, base symmetric or asymmetrically obtuse, light green, conspicuously vernicose and glabrous on the upper surface; the lower surface opaque and lighter green and with very short and inconspicuous unicellular hairs only on the veins and veinlets and some tetralobular glandular hairs on the rachis and petiolules. Terminal leaflet very narrowly lanceolate or linear-lanceolate, narrower than the laterals, 2.5-4.0 cm long by 0.2-0.5 cm wide, base narrowly cuneate, petiolules 2-6 mm long; upper lateral leaflets of approximately equal length as the terminal, sessile or subsessile as in the case of all the lower pairs; middle lateral leaflets longer and wider than the rest, 3.5-5.0 cm long by 0.6-0.8 cm wide, on petiolules to 2.5 mm long; interjected leaflets 1-7 mm long, apex obtuse, base oblique and sessile. Pseudostipular leaves conspicuous, clasping to obliquely auriculate, 5-10 mm long by 3.5-5.0 mm wide. Inflorescence cymose to cymose-paniculate, 3-7 flowered; peduncle tinted light brown, short, 1.5-2.5 cm, slender, 1.0-1.5 mm in dia., glabrous as in the case of the pedicels and the calyx, simple or forked one or two times; pedicels 10-15(-20) mm long, light brown, articulated near the center or 6-7 mm below the base of the calyx. Calyx asymmetrical or symmetrical, small, 5 mm long, light green, tinted pale lilac at base, lobes subquadrate to ovate-lanceolate, scarious at base, apex abruptly narrowing to acumens pointed, 1-2 mm long. Corolla rotate, white, 2.5-3.0 cm in dia., occasionally with 6 petals (igs. 287, 288), internal star yellowish-green when immature and grayish-white when mature, glabrous except for the acumens, which are densely pubescent along the apical margins and external side. Staminal column cylindrical-conical, anthers lanceolate or narrowly elliptic-lanceolate, 5.0-5.5 mm long, without a well defined dorsal suture, base deeply cordate; filaments 1.0-1.5 mm long, white-hyalinous, glabrous. Style 8.5-9.0 mm long, exerted 1.5 mm, slightly more enlarged below

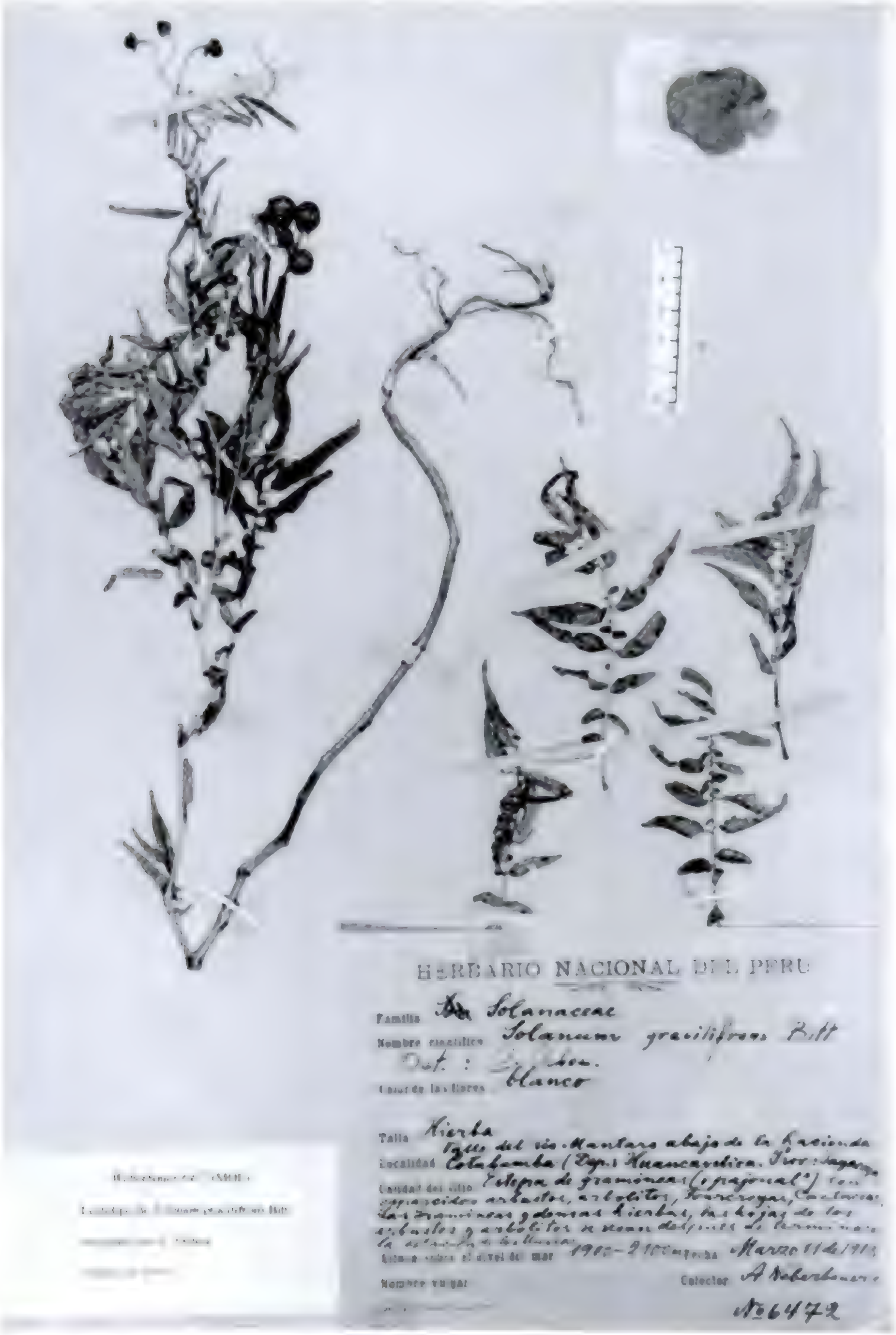


Figure 286. *Solanum gracilifrons* (Weberbauer-6472, lectotype).

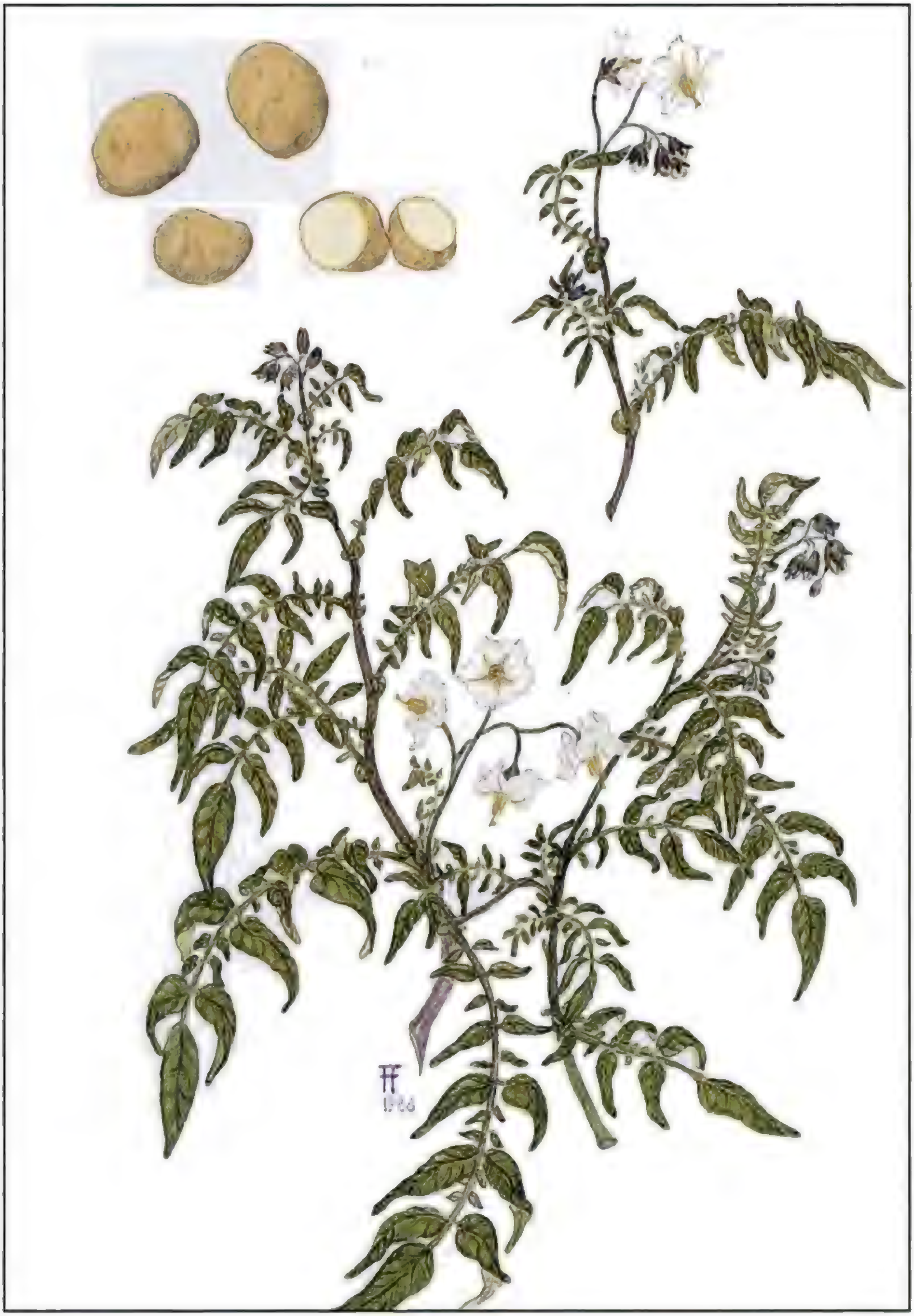


Plate XXVII. *Solanum gracilifrons* Bitt.

the midpoint, sparsely papillose along the basal one-third of its length; stigma claviform and cleft. Fruit round, 10-12 mm in dia., light green, speckled with small white dots at apex. Chromosome Number: 2n=24.

Type: PERU. Department Huancavelica, Province Tayacaja, Mantaro River Valley, below Hacienda Cotabamba, 1900-2000 m alt., 11 March 1913, *A. Weberbauer* 6472 (B, destroyed; GOET, fragment and drawing; MOL lectotype, here designated; OCH).

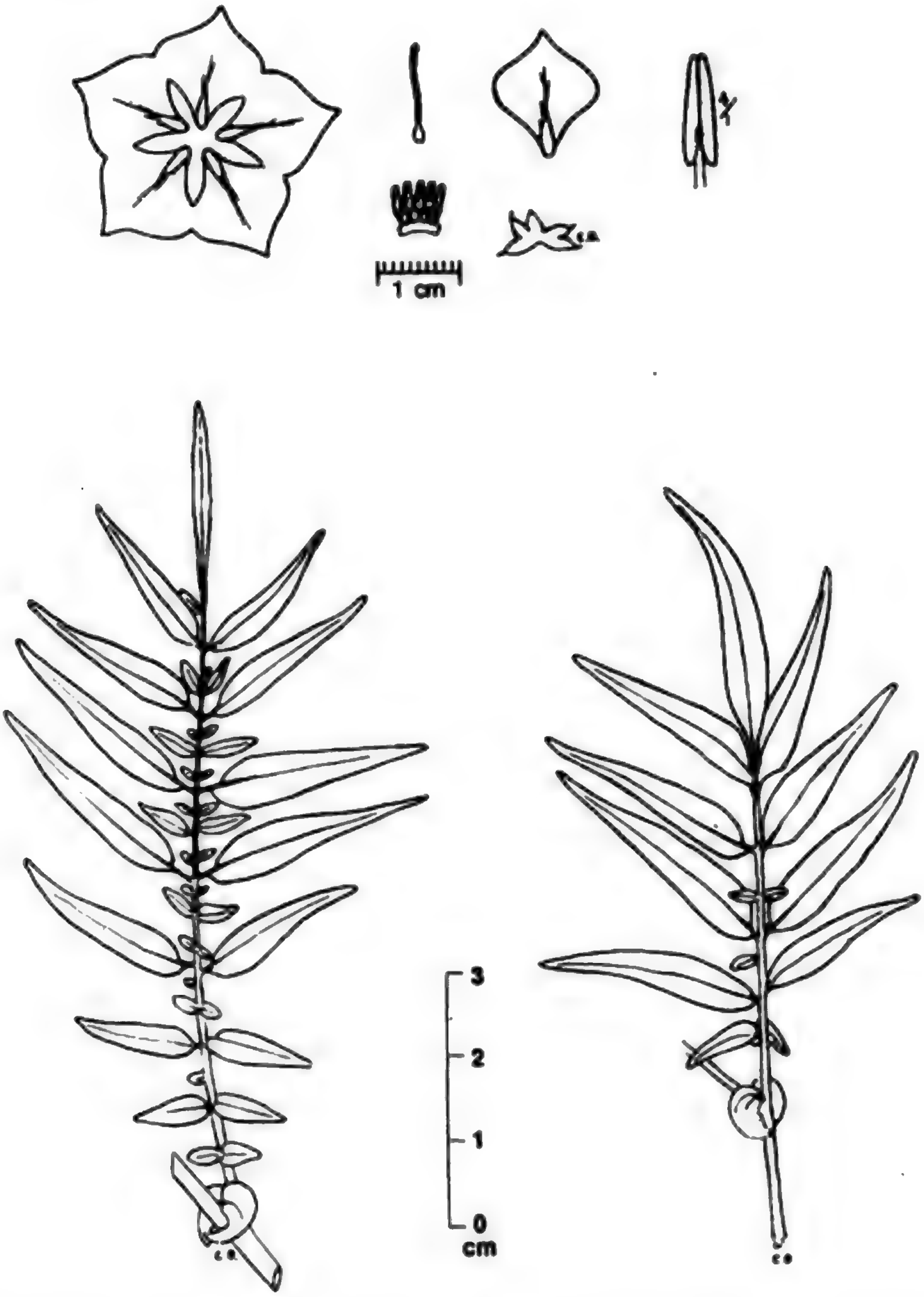


Figure 287. Floral dissection and leaves of *Solanum gracilifrons* (*Ochoa 990*).

This rare species is basically extinct. In March 1996, there was an intensive search for it near hacienda Villa Azul and in "Peninsula de Tayacaja" and "Bajo Mantaro." Unfortunately, no specimens were found. The last living collection of this species is thus the one collected by the author in January 1979 (Ochoa 13117), and presently maintained in the CIP germplasm bank.

Affinities

While bearing a superficial resemblance to *S. chillonanum*, this unique species is apparently not closely related to it nor to any other species in Series Tuberosa.

Habitat and Distribution

Solanum gracilifrons grows under temperate and fairly mild climatic conditions in narrow, semidry quebradas at elevations ranging between 1600 and 2000 m. It occurs mainly in patches of shrub forest on rocky slopes, where it may be associated with *Eupatorium*, *Fourcroya*, *Lantana*, and various species of grasses and cacti.

At present, this species is known only from a small area immediately to the east of Colcabamba, the latter situated below the Mantaro River in the Province of Tayacaja, Department of Huancavelica, in central Peru (Map 25).

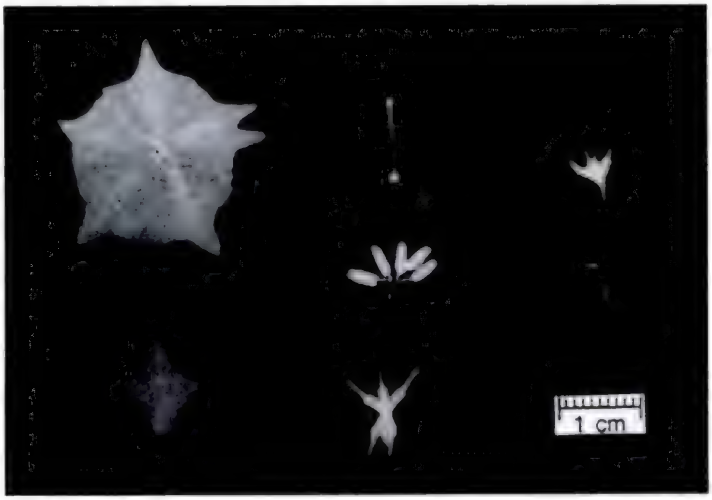


Figure 288. Floral dissection of *Solanum gracilifrons* (*Ochoa 13117*).

Specimens Examined

Department Huancavelica

Province Tayacaja: Mantaro River Valley, below Hacienda Cotabamba, 1900-2000 m alt.,"grassland ('pajonal') with few trees, shrubs, *Fourcroya*, cacti, grasses and some herbs, the leaves of the trees and shrubs falling upon the termination of the rainy season," 11 March 1913, *A. Weberbauer 6472* (B, destroyed; GOET, fragment and drawing; MOL; OCH, type collection of *S. gracilifrons*). Two km north of Hacienda Villa Azul, 1900 m alt., travelling down the railroad line from Colcabamba to the Mantaro River, on dry, sandy-rocky slopes, in shrubby thickets, with *Fourcroya, Lantana, Opuntia* and grasses, leaves vernicose and very divided, flowers white, 17 February 1951, *C. Ochoa 990*, 2n=24 (GH, OCH, US). Near and below Hacienda Villa Azul, 1600-1800 m alt., heading down from Colcabamba toward Quebrada de Tocas, on dry, rocky slopes and in small shrub forests, very rare, almost 50 plants in various stages of development, from 5 to 30 cm tall, were found in a half meter square quadrant, leaves conspicuously vernicose, plants not in flower, 22 January 1979, *C. Ochoa 13117*, 2n=24 (OCH), and *13117A* (CIP, GH, MOL, OCH, US, from plants propagated at Huancayo).

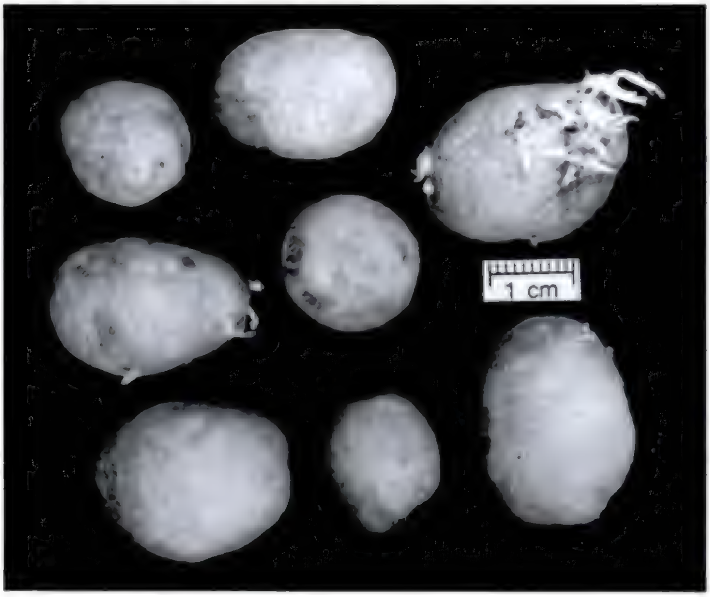
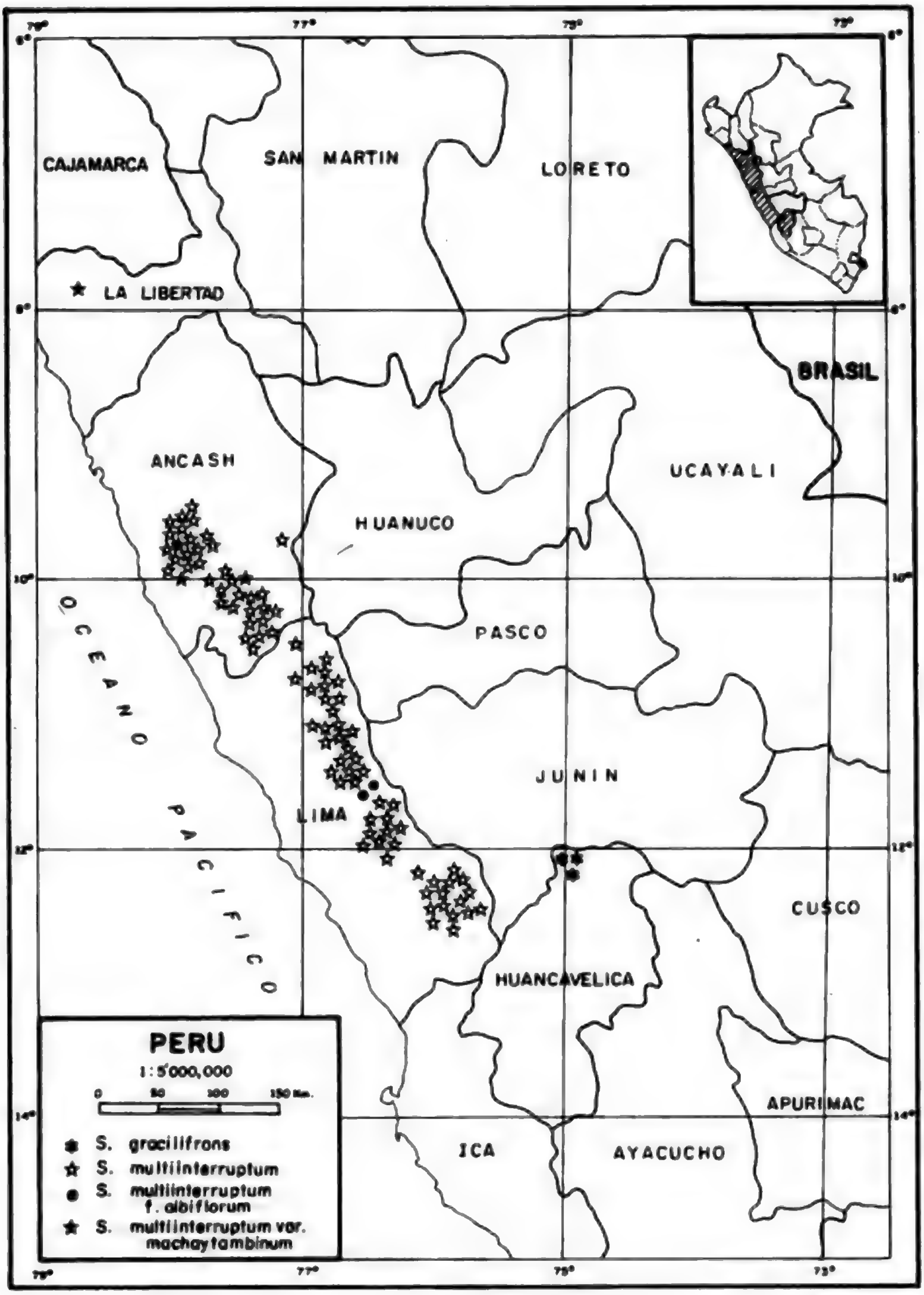


Figure 289. Tubers of *Solanum gracilifrons (Ochoa 13117).*



Map 25. Distribution of *S. gracilifrons*, *S. multiinterruptum*, *S. multiinterruptum* f. *albiflorum* and *S. multiinterruptum* var. *machaytambinum*.

60. *Solanum huancabambense* Ochoa, Agronomía, Lima, 26:109-110, illustr., 1959. Figs. 290-294; Map 26; Plate XXVIII.

Plant erect-ascending, (25-)40-50 cm de tall, glabrescent, light green; stem simple or branched, (3-)5-8 mm in dia. at base, slightly pigmented along the basal one-third of its length and in the leaf axils, the upper portion light green, wings straight, 1.0-1.5 mm wide; internodes 2.5-4.5 cm de long. Roots deep, stolons very long, 150 cm or more in length, tubers uniformly round a ovoid, 3-5 cm long, very lenticulate, whitish-yellow, eyes superficial. Leaves (7.0-)9.0-17.5 (-20.5) cm long by (3.0-)6.5-11.0(-12.0) cm wide, imparipinnate, with 3-4(-5) pairs of leaflets laterals and 0-3(-4) pairs of interjected leaflets, glabrous or subglabrous, pale green and slightly vernicose above, very light green and almost whitish and sparsely pilose below; hairs simple, short and fine. Rachis, petioles and petiolules with very short glandular and tetralobular hairs. Leaflets ovate to ovate-elliptic or elliptic, apex obtuse or somewhat pointed; lateral leaflets obliquely rounded at base, usually subsessile or shortly petiolulate, petiolules up to 5 mm de long. Terminal leaflet slightly larger than the laterals, (3.0-)4.0-5.7 cm long by (2.0-)2.5-3.5 cm wide; lateral leaflets of the first upper pair nearly the same size as those of the second upper pair, (1.0-)3.4-5.0 cm long by (0.7-)1.6-2.4 cm wide. Pseudostipular leaves broadly falcate, 7-10 cm long. Inflorescence cymose, terminal or lateral, 10-15-flowered; peduncle vigorous, 8-12 cm long by 2.5 mm in dia. at base, glabrous, pigmented, once or twice bifurcate. Pedicels 15-25(-30) mm long, light green, subglabrous, pilose, articulated above center or in the upper one-third of their length (*i.e.*, about 5-6 mm below the base of the calyx). Calyx symmetrical or asymmetrical, 6-7 mm long, pilose, hairs brilliant white, about 1.5 mm long, lobes ovate-triangular to rectangular-subquadrate, shortly acuminate, acumens pointed, 1.5 mm long. Corolla pentagonal or substellate, 2.5-3.0 cm in dia. (Figs. 291, 292), yellowish white or white with a yellow internal star, lobes ovate to ovate-triangular, 8-9 mm long by 10-12 mm wide at base, acumens scarcely distinguishable from the densely puberulent margins. Anthers broadly lanceolate, 5.5 mm long; filaments to 1 mm long, glabrous. Style 9-10 mm long, exerted 4-5 mm, papillose about the midpoint or in the upper one-third of it length; stigma capitate, cleft, slightly thicker than the apex of the style. Fruit subglobose to ovoid, 1.5-2.0 cm long, light green, flecked with white dots (fig. 293). Chromosome Number: 2n=24. EBN=2.

Type: PERU. Department Piura, Province Huancabamba, Jusgara, 1800 m alt., near Huancabamba, 20 June 1952, *C. Ochoa 2023* (holotype OCH; isotypes LE, P, from plants grown at Huancayo, Mantaro Valley, propagated in 1953 from tubers originally collected at Jusgara).

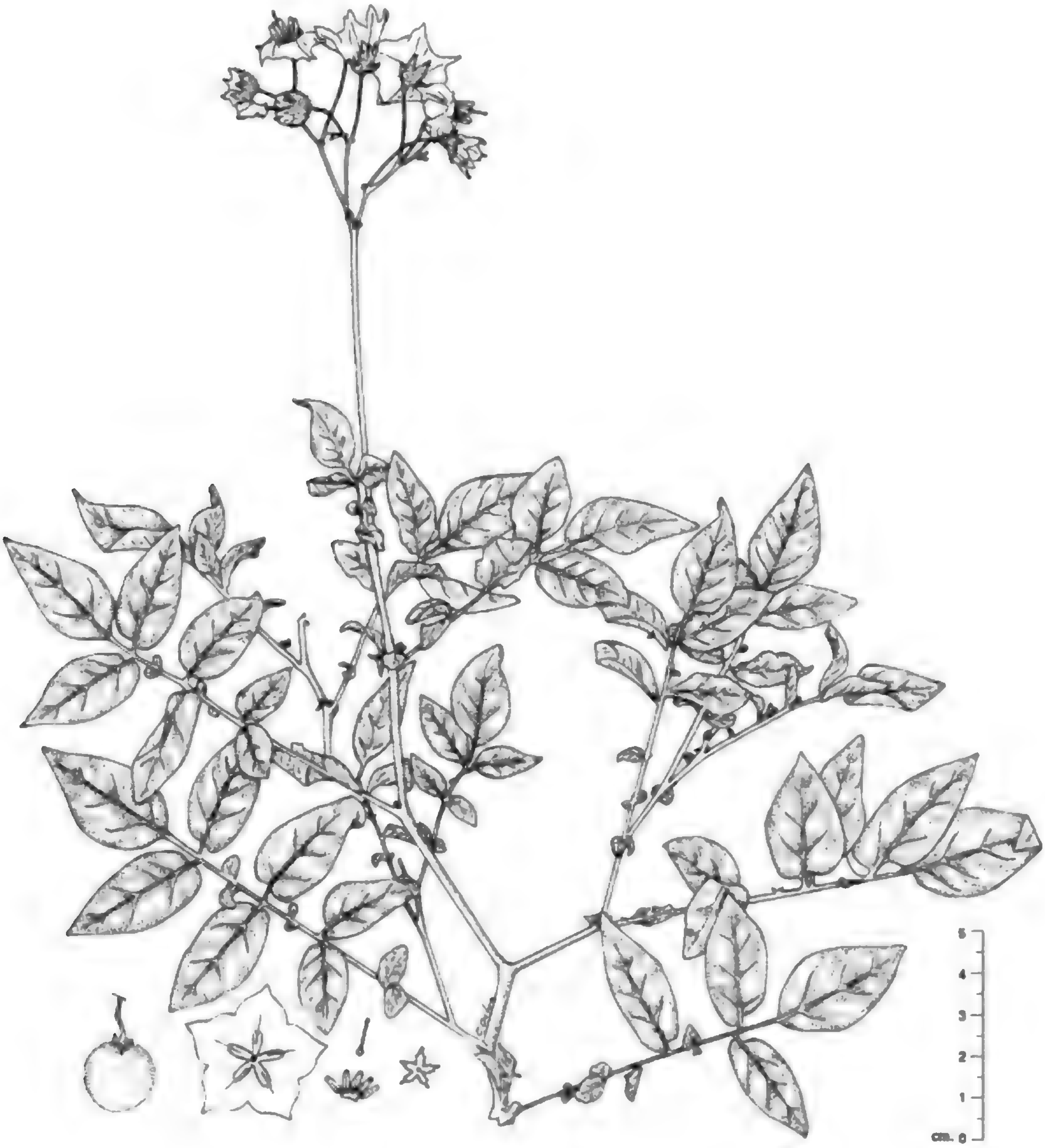


Figure 290. *Solanum huancabambense* (*Ochoa 2573*, topotype).

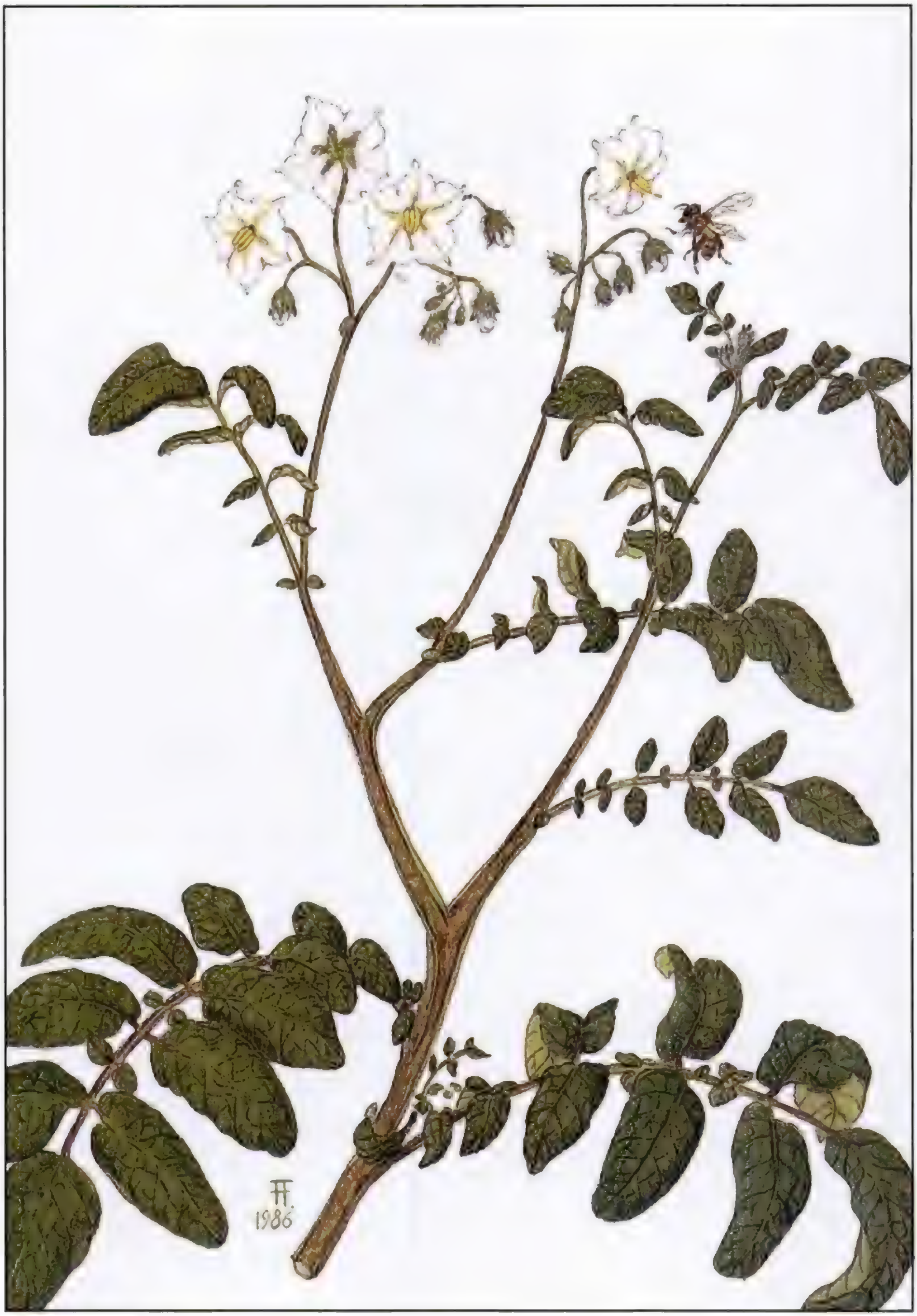


Plate XXVIII. *Solanum huancabambense* Ochoa.

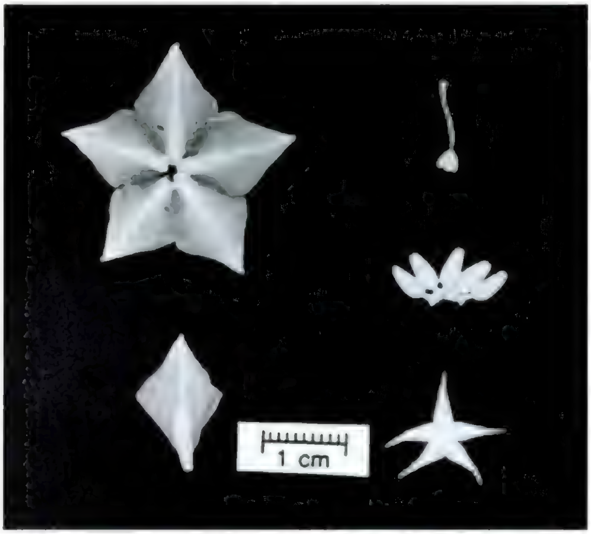


Figure 291. Floral dissection of *Solanum huancabambense* (*Ochoa 2337*).

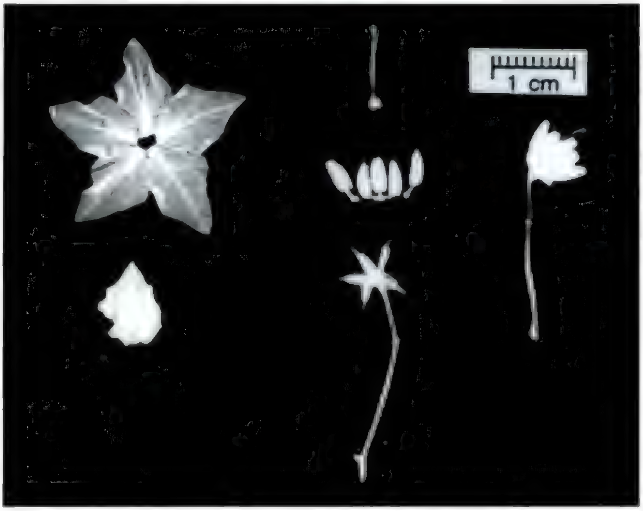


Figure 292. Floral dissection of *Solanum huancabambense* (*Ochoa 11626*).

A number of variant types are incorporated within this species. For example in different collections of *S. huancabambense*, the fruit varies from subglobose, as in *Ochoa 2573*, to ovoid, as for example in *Ochoa* collections *2337* and *3669*; whereas the leaflets, which are subsessile in the great majority of the collections that have been examined, are long petiolulate (5-7 mm) in *Ochoa* collections *2339* and *2474*. The degree of dissection of the leaves also varies considerably within the species. Although biotypes with 3-4 pairs of lateral leaflets and 0-2 pairs of interjected leaflets are the most common types to be found in nature, its not unusual to come across plants that have 5 pairs of leaflets and 4-5 pairs of interjected leaflets.

Affinities

At the time of the publication of *S. huancabambense* (see Ochoa, 1959, p. 109), the writer suggested this species had many attributes in common with plants of the Series Commersoniana. A few years later, Correll (1962, p. 176), in his treatment of *S. limense*, unwittingly confirmed the writer's opinion in this regard by pointing out the closeness of this species to *S. huancabambense*. Significantly, the plant that Correll had under consideration is now considered to be a synonym of the species *S. chacoense* of the Series Commersoniana (cf. Ochoa, 1962, 1990). However, not all have agreed with the placement of S. chacoense in Series Commersoniana. Hawkes (1990, p. 98), for example, whose treatment of *S. limense* is in other respects similar to that of the author's, has placed this species under the Series Yungasensa Corr.

The very similar-appearing leaves and white flowers of *S. huancabambense* and *S. chacoense* are the two principal links that connect these species. However, it should be noted that the two are very different with respect to calyx size, depth and width of the corolla lobes, and the positioning of the pedicel articulation. Moreover, the two are separated in nature by a significant gap in distribution.

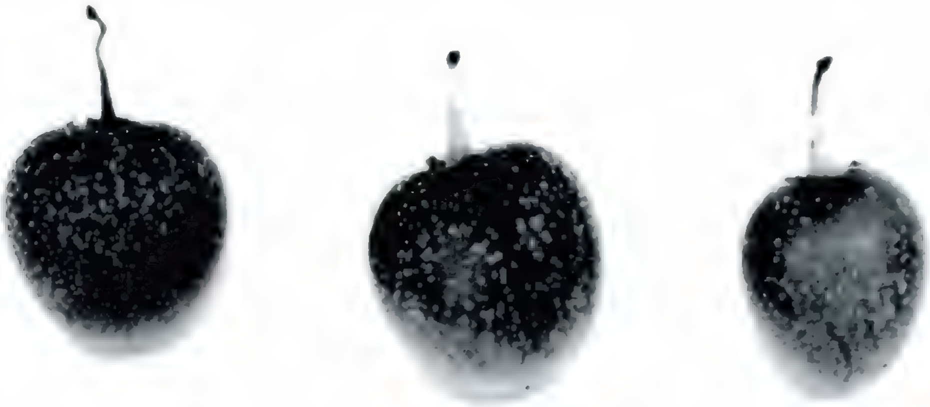


Figure 293. Berries of *Solanum huancabambense* (*Ochoa 14815*), Totoral, Jusgara.

Habitat and Distribution

Although *S. huancabambense* grows preferentially in temperate valleys and quebradas between 1800 and 2300 m altitude, it is also known from the higher, cooler mountain slopes and *jalca* grasslands of northern Peru at elevations ranging between 2500 and 2900 m. In various parts of its range it has been collected from pasture lands, borders of cultivated fields and hedgerows of *Agave* and *Eupatorium*, where it has been reported to grow intermixed with grasses and various herbaceous species of the genus *Verbena*, *Plantago* and *Passiflora*.

Specimens Examined

Department Lambayeque

Province Lambayeque: On a brushy bank, 46 km from Olmos, on road to Jaén, 2150 m alt., tubers round, up to 2.5 cm in dia., plant not flowering, 26 March 1960, *D.S. Correll and E. Smith P827* (LL). Heading up from El Sauce toward the Porculla Pass, 1950 m alt., along the Olmos-Bagua road, in shrubby thickets, 2 April 1963, *C. Ochoa 2474* (OCH). Cuello or Porculla Pass, ca. 2000 m alt., 13 May 1964, *C. Ochoa S-49,* 2n=24 (= *PI-365359*, from plants grown in the experimental field at Sturgeon Bay, Wis., U.S.A., summer 1987). Near Porculla Pass, 1650 m alt., along the Olmos-Bagua road, tubers only were collected, 10 May 1992, *C. Ochoa 16150* (OCH, from plants grown at La Molina, Lima, in November 1992).

Department Piura

Province Ayabaca: Near Pacaipampa, 2000 m alt., District Cumbicus, 13 May 1960, *C. Ochoa 2339* (MOL, OCH).

Province Huancabamba: Jusgara [not Jusgarda], ca.1800 m alt., near Huancabamba, heading down from Cuello del Indio Pass toward Huancabamba, plants withered, tubers white, 20 June 1952, *C. Ochoa 2023* (LE, OCH, P, type collection of *S. huancabambense*, plants grown at the Experimental Station at Mantaro from tubers originally collected at Jusgara). Above Jusgara, 2350 m alt., near Huancabamba in foothills of a reddish clay mountain, within a border of *Agave* sp., *Verbena* and *Ranunculus*, 4 May 1960, *C. Ochoa 2325* (OCH, US, topotype of *S. huancabambense*). Causol, ca. de 1800 m alt., below Jusgara, heading down towards Huancabamba, 4 May 1960, *C. Ochoa 2326* (GH, OCH). Cerro Paratón, 2500-2900 m alt., along the route from Chupicapinca to Quebrada Grande, about 7 km northeast of Huarmaca, 12 May 1960, *C. Ochoa 2337* (OCH) and *2338* (OCH). Heading down from Cuello del Indio Pass toward Huancabamba, ca. 2000 m alt., near Jusgara, 2 April 1964, *C. Ochoa 2573*

(OCH, topotype). Near Cerro Paratón, northeast of Huarmaca, 2500 m alt., May 1973, C. *Ochoa 3669* (OCH, plants grown at the Universidad Nacional Agraria La Molina, Lima, from original seed). Jusgara, 2500 m alt., at km 22 of the Huancabamba-Canchaque road, 20 May 1974, Z. *Huamán 966* (CIP, OCH, topotypes). Shilcapampa-Shilcaya, ca. 2000 m alt., about 2 km south of Sondor, near the Quebrada de Curlata, flowers white, 20 April 1977, C. *Ochoa 11619*, 2n=24 (CIP, GH, MOL, OCH, US). Maraypampa, 1800 m alt., near Sondor, Huancabamba, 21 April 1977, C. *Ochoa 11626*, 2n=24 (CIP, GH, MOL, OCH,

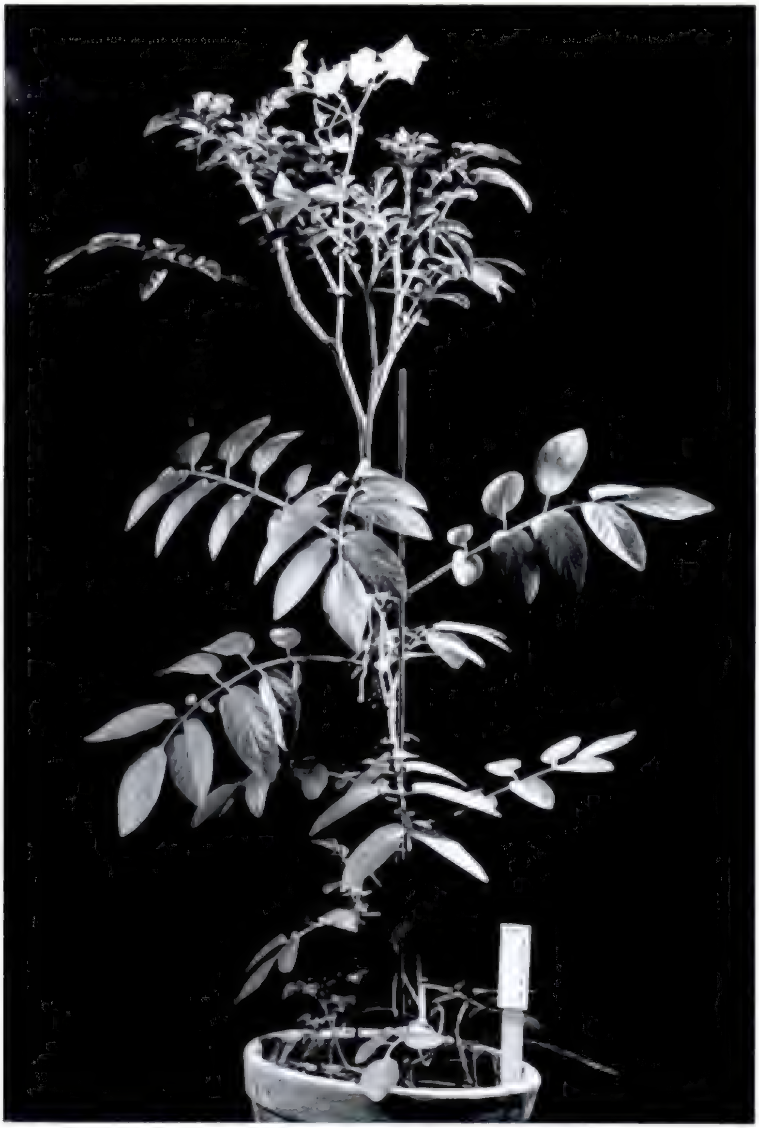


Figure 294. Plant of *Solanum huancabambense*, Piura.

US). Jusgara, 2000 m alt., between Cuello del Indio Pass and Huancabamba, April 1977, *C. Ochoa 11627*, 2n=24 (CIP, MOL, OCH, topotypes of *S. huancabambense*). Los Cedros, 2600 m alt., before Monte Redondo, District Sondor, along the horse trail from Sondor to Tabaconas, scarce, plants senescent, past flowering, 20-27 May 1982, *C. Ochoa 14812* (CIP, F, OCH, US, W). Totoral, 2900 m alt., between Cuello del Indio Pass and Huancabamba, at the margins of a maize field and within borders formed by *Agave* sp., 20-27 May 1982, *C. Ochoa 14815*, 2n=24 (CIP, OCH). Causol, ca. 1900 m alt., between Jusgara and Huancabamba, without date, *C. Ochoa S-021*, 2n=24 (= *PI-365406*, from plants grown in the field at Sturgeon Bay, Wis., U.S.A., Summer 1987).

Putative Natural Hybrid of *Solanum huncabambense* Ochoa

Solanum huancabambense × *S. olmosense*

Department Lambayeque

Province Lambayeque: Lower slopes of Cerro Coco, ca. 1600 m alt., scaled by foot about 7 km to the left, near km 28 of the Olmos-Porculla road, growing near very immature plants of *S. olmosense*, 18 July 1981, *C. Ochoa 14493*, 2n=24 (OCH).

The above collection appears to be a natural occurring hybrid of *S. huancabambense* and *S. olmosense*. Although the general aspect of this putative hybrid corresponds very closely to *S. huancabambense*, including the rotate-pentagonal to substellate corolla, the calyx shape is typical of *S. olmosense* and the leaves, while not having a broadly winged rachis, have 4-6 pairs of interjected leaflets.

Breeding Potential

The results of crosses of *S. huancabambense* (2n=24 and EBN=2) with diploid species of EBN=1 or EBN=2 are given in Table 72; whereas, the field materials used for these experiments are shown in Table 73.

Although our results show compatibility between *S. huancabambense* (EBN=2) and S. mochiquense (EBN=1), the amount of viable seed that was actually obtained in reciprocal crosses between these two species was in reality very moderate. Similarly, while some compatibility was shown in crosses involving *S. incahuasinum* (also EBN=1), berries containing viable seed were obtained only when the latter species was used as the staminate parent.

Mixed results were also obtained in crosses involving *S. huancabambense* and others having identical EBN values. Complete success was had in the reciprocal crosses involving *S. ambosinum*, *S. bukasovii* and *S. medians*; whereas, reciprocal crosses involving *S. phureja*, *S. goniocalyx*, *S. orophilum* and *S. bukasovii* f. *multidissectum* yielded seed only when the aforementioned plants were used as the pistillate parents. Lastly, it was observed that unilateral crosses between *S. huancabambense* and *S. paucissectum* and *S. medians-3x* were moderately successful, yielding only fair amounts of viable seed.

Table 72. Fertility of *Solanum huancabambense* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	TUBEROSA	× *S. incahuasinum*	29(8)	11(5)	24(0)
			× *S. mochiquense*	65(10)	52(2)	48(83)
24	2	CONICIBACCATA	× *S. chomatophilum*	12(8)	7(0)	142(0)
24	2	PIURANA	× *S. paucissectum*	22	16	63
24	2	TUBEROSA	× *S. ambosinum*	10(22)	6(12)	83(142)
			× *S. bukasovii*	29(20)	22(10)	68(75)
			× *S. bukasovii* f. *multidissectum*	3(2)	2(2)	0(145)
			× *S. coelestispetalum*	10(13)	0(0)	0(0)
			× *S. goniocalyx*	18(11)	10(2)	0(20)
			× *S. marinasense*	13	9	0
			× *S. medians*-2x	14(4)	10(4)	55(175)
			× *S. medians*-3x	8	2	25
			× *S. orophilum*	4(19)	1(13)	0(380
			× *S. phureja*	86(5)	49(2)	0(570)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 73. Collections (OCH) used in *Solanum huancabambense* fertility studies.

CONICIBACCATA
S. chomatophilum 10728, 13012, 13325

PIURANA
S. paucissectum 11633

TUBEROSA
S. ambosinum 11865, 13852
S. bukasovii 7953, 11337, 13707, 13729
S. bukasovii f. *multidissectum* 11868
S. coelestispetalum 13690, 14341
S. goniocalyx 00001
S. huancabambense 11619, 11626, 11627, 14815
S. incahuasinum 11613
S. marinasense 13673, 13675
S. medians-2x 13268
S. medians-3x 11883
S. mochiquense 14870, 15995
S. orophilum 13003, 13021
S. phureja 5186, 5188, 5189, 13896, 13909, 15052, 15071

61. *Solanum huancavelicae* Ochoa *sp. nov.* (See Latin diagnosis in Spanish edition).

Fig. 295; Map 29.

Plant erect, small or medium-sized, (15-)30-40 cm tall, sparsely pubescent. Stem simple, flexible, slender, 2.0-3.5 mm in dia., without wings or with very narrow, scarcely distinguishable wings; internodes (1-)2-3 cm long. Stolons white, 40-50 cm long, very slender, 1.0-1.5 mm in dia.; tubers extremely small, 0.5-1.0 cm in dia., round, white. Leaves 9.5-11.5 cm long by 6.5-8.0 cm wide, imparipinnate, with 2(-3) pairs of leaflets and 0-1 pair of interjected leaflets, very sparsely pilose throughout, including the upper surface of the rachis and the petiolules, hairs very short, adpressed, brilliant-white; somewhat less pilose below and only on the principal nerves. Terminal leaflet ovate, acuminate at apex and obtuse at base, somewhat larger than the adjacent lateral leaflets, 4.5-5.5 cm long by 2.5-3.0 cm wide; lateral leaflets elliptic-lanceolate, pointed at apex and obtuse to obliquely rounded at base, on petiolules 1.5-3.0 mm long; the first pair of lateral leaflets 3.5-4.5 cm long by 1.5-2.0 cm wide. Pseudostipular leaves broadly subfalcate or narrowly and asymmetrically elliptic-lanceolate, to 10 mm long. Inflorescence cymose to cymose-paniculate, 2-7-flowered; peduncle short, 2.5-3.5 cm long, sparsely pubescent or puberulent as in the case of the pedicels, very slender, scarcely 1.0-1.5 mm in dia., forked, the divisions 2.5 cm long; pedicels 15-20 mm long and less than 1 mm in dia.; articulated above center or in the upper one-third of their length, about 5-6 mm below the base of the calyx. Calyx symmetrical, sparsely pubescent, 7-8 mm long; lobes narrowly elliptic-lanceolate,

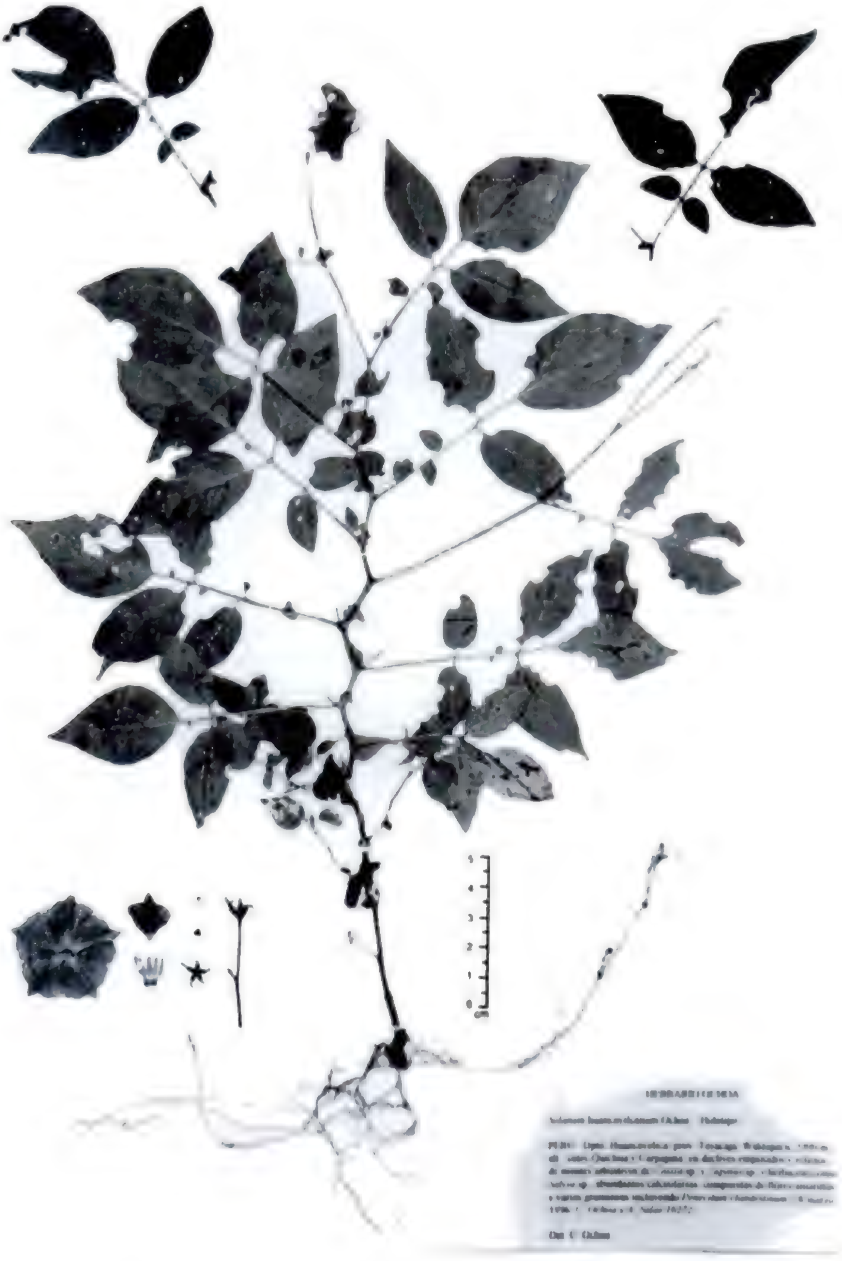


Figure 295. *Solanum huancavelicae* (*Ochoa and Salas 16272*, holotype).

the margins scarious, abruptly narrowed to 3-4 mm long pointed acumens. Corolla rotate, 3 cm in dia., indigo-blue, with a grayish-white internal star. Anthers 6 mm long, narrowly lanceolate, base conspicuously cordate; filaments 1.5-2.0 mm long, glabrous. Style 10 mm long, papillose along the basal one-third of its length; stigma capitate, cleft; ovary oval-pyriform. Fruit small, 1.0-1.5 cm in dia., pale green with scattered white dots not verrucose (Fig. 295). Chromosome Number: 2n=24. Proposed Abbreviation: HCV.

Local Name: *Atokk Papa*.

Type: PERU. Department Huancavelica, Province Tayacaja, Wakktapacu, 3300 m alt., between Quichua and Carpapata, on steep xerophytic rocky slopes and in relic stands of mountain shrub communities of *Cassia* and *Lupinus* sp., with many *Calceolarias*, composites and grasses including *Pennisetum clandestinum*, n.v. *Atokk Papa*, very rare, 28 March 1996, *C. Ochoa and A. Salas 16272* (holotype OCH, isotypes CIP, MOL). Paratype C. *Ochoa and* A. *Salas 16273* (CIP fragment, OCH), collected in the same locality as the type and also in relic stands of shrub communities, on moist rocky soils.

Affinities

Solanum huancavelicae is related to the south Peruvian species, *S. velardei*. The two have a number of characteristics in common, including leaves that are similar in shape and dissection, enlarged terminal leaflets, pedicel articulations that are located in approximately the same positions and small tubers.

Distribution

This species is presently known only from its type locality near the Village of Wakktapacu in the Province of Tayacaja, Department of Huancavelica, in central Peru (Map 29).

62. *Solanum huarochiriense* Ochoa, in *Los Solanum Tuberíferos Silvestres del Perú*, Lima, 215-217, illustr., 1962. Figs. 296-301; Map 24.

Plant erect, bushy, small, (15-)25-40 cm tall, essentially glabrous; stem simple or little-branched, 3-7 mm in dia. at base, light green or slightly pigmented in the leaf axils and along the basal one-third of its length, wings straight and very narrow, scarcely distinguishable; internodes (0.5-)1.0-3.0(-5.0) cm long. Stolons 35-80 cm long, usually thick, 2.5-3.5 mm in dia.; tubers white, round to ovoid or long-cylindrical, the terminal ends obtuse or fusiform, small, 1-3 cm long (Fig. 299). Leaves short and broad, (7.5-)10.0-17.0(-19.5) cm long by (4.0-)5.4-7.6(-10.0) cm wide, glabrous on both sides, dark green and slightly brilliant above and uniformly light green or light green diffused with pale violet below, imparipinnate, with 2-3(-4) pairs of leaflets and 0-1 pair of interjected leaflets. Terminal leaflet ovate or broadly elliptic, obtuse to somewhat pointed at apex, broadly rounded to cuneate at base, narrowly decurrent about the petiolule, somewhat larger than the first pair of lateral leaflets, (2.4-)3.5-7.5 cm long by (1.8-) 2.8-4.2 cm wide. Lateral leaflets elliptic, obtuse at apex, symmetric or asymmetrically rounded at base, on petiolules 1.5-3.0 mm long; the first pair of lateral leaflets (1.6-)3.0-6.5 cm long by (0.8-)1.5-3.6 cm wide. Interjected leaflets, when present, ovate to suborbicular, very small, 1-3 mm long. Pseudostipular leaves sublunate or broadly subfalcate, 5-12 mm long by 3-7 mm wide. Inflorescence lateral and terminal, cymose or cymose-paniculate, (3-)6-10-flowered; peduncle up to 7 cm long and 1.5-2.0 mm in dia. at base, light green, glabrous as in the case of the pedicels and calyx, forked 1-2 times; pedicels slightly pigmented, 25-35(-45) mm long, slender, less than 1 mm in dia., articulation high, usually (3-)4-6 mm below the base of the calyx. Calyx symmetrical, small, 5 mm long, varying from light green to deep violet or almost black, lobes broadly ovate, obtuse or subapiculate at apex. Corolla rotate, 3.0-3.5 cm in dia. (Fig. 297), violet-lilac or blue, with darker blue tones at base of the petals and near the interpetalar membranes, with a light yellow internal star, acumen margins puberulent. Anthers lanceolate or slightly elliptic-lanceolate, pale yellow or lemon-yellow, 5 mm long, distinctly cordate at base; filaments about 1 mm long, white-hyalinous or tinted blue violet, glabrous. Style 8-10 mm long, exerted 4-5 mm, very slender or filiform, densely papillose along the basal one-third of its length; stigma claviform, cleft, slightly enlarged at apex. Ovary ovate-pyriform, entirely or partially colored deep purple. Fruit globose, 1.5-2.0 cm in dia., green, basely diffused with violet or green with 1-2 vertical deep violet stripes (Fig. 298). Chromosome Number: 2n=24. EBN=2.

Local Names: *Papa Ñame*, in Escomarca, Huarochirí; *Añas Papa* in Lachaqui, Canta; the fruit is called *Shuculanga* in Pachacosa and *Turucha* in Pacomanta, Huarochirí.

Type: PERU. Department Lima, Province Huarochirí, Pachacosa, 3750 m alt., near Aguacha, along the Lima-Huarochirí road, April 1960, C. *Ochoa 2308* (holotype OCH, isotypes CIP, MOL, US, USM).

Although the plants of this species are usually glabrous, in some collections the leaves are sparsely pilose. For example, in *Ochoa 11331* or *11335*, scattered

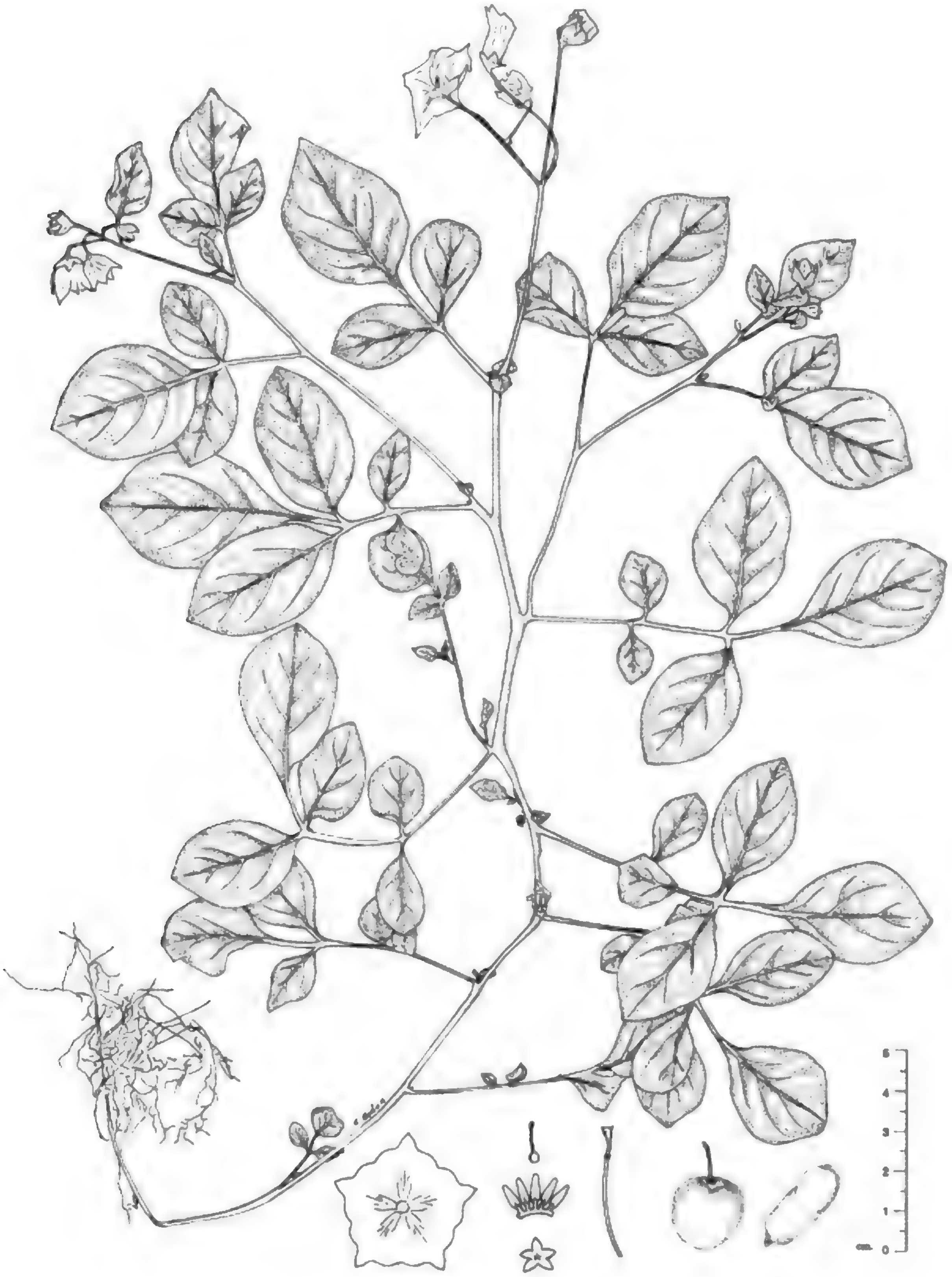


Figure 296. *Solanum huarochiriense* (*Ochoa 11331*, topotype).

short hairs are found on the upper leaf surfaces, as well as along the veins and veinlets of the lower surfaces. Also, in the aforementioned collections, the leaf axils are clad with a few short, tetralobular-glandular hairs.

As the flowers of *S. huarochiriense* are very colorful and showy, it is possible that this species may some day find a use as a garden ornamental.

Affinities

This species is related to *S. chomatophilum*. The two are similar in having small calyces and glabrous, elliptic or broadly elliptic-lanceolate leaflets that are somewhat shiny above and lightly tinted with violet below. However, *S. huarochiriense* differs markedly from *S. chomatophilum* in having pedicels that are articulated just beneath the base of the calyx and in producing globose fruits and many, well-formed tubers.

Habitat and Distribution

Solanum huarochiriense appears to be one of the very few wild potato species that are well adapted for survival in the extremely high and cold (3500-4400 m alt.) *puna* or *jalca* plant formations of Peru. Of the 45 herbarium collections that are cited below and in which information on altitude has been included in the label, 40 were originally obtained from mountainous regions situated between 3600 and 4200 m.

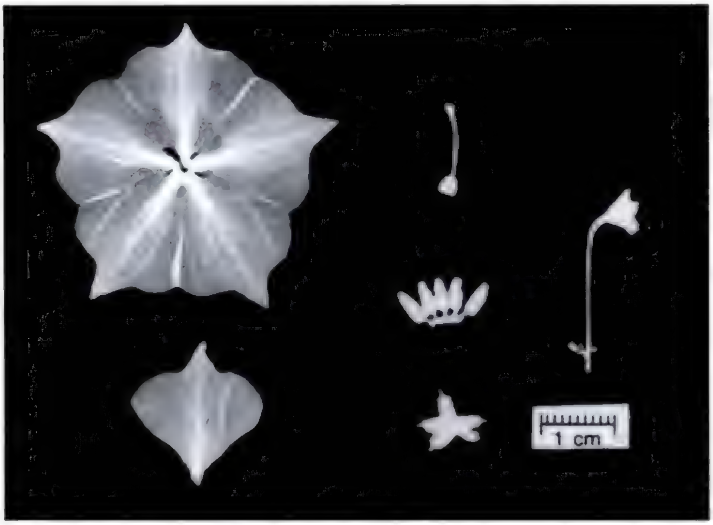


Figure 297. Floral dissection of *Solanum huarochiriense* (*Ochoa 11329*).

This species occurs commonly in the crevices and hollows of large rocks, along the borders of stone or earthen walls or enclosures and among the rocks, stones and boulders of mountain slopes. It is less frequently found on hillsides or plains dominated by *Stipa* or other native grasses. In various parts of its range, *S. huarochiriense* grows with herbaceous plants of the genus *Verbena*, *Ranunculus*, *Lupinus* and *Cajophora*, or in forest patches associated with *Salpichroa*, *Chuquiraga*, *Bidens*, *Hypericum*, *Berberis*, *Eupatorium* and *Polylepis*. Only rarely, such as at its type locality, has it been collected with *S. acaule*, *S. bukasovii* and *S. multiinterruptum*, or other tuber-bearing species.

Solanum huarochiriense is known from the Provinces of Canta and Huarochiri of the Department of Lima in central Peru, and the Provinces of Aija, Bolognesi, Huaraz and Huaylas of the Department of Ancash in northern Peru (Map 24).

Specimens Examined

Department Ancash

Province Aija: Huehuash, 3900 m alt., near the water intake of Huarmán, April 1971, *C. Ochoa 2981* (OCH). Between Carap and Cuchucuchu, 3900-3950 m alt., facing Wuamanwilca, heading up to Huarmán, April 1971, C. *Ochoa 2982* (OCH), *3045* (OCH, from the original plant) and *3045-A*, 2n=24 (OCH, from plants grown at Universidad Nacional Agraria La Molina, Lima, in Decem-

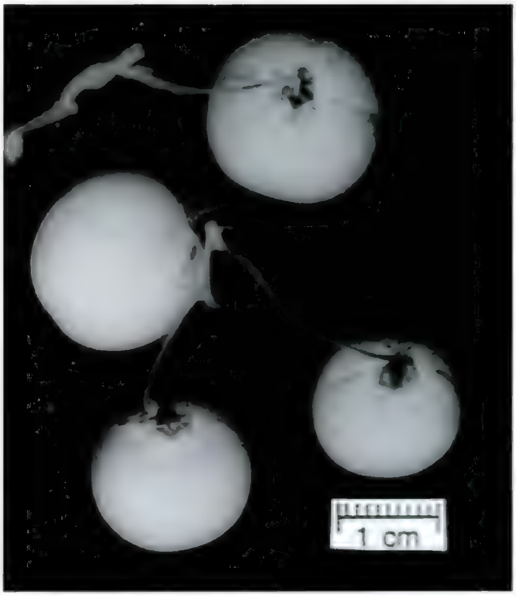


Figure 298. Fruits of *Solanum huarochiriense* (*Ochoa 11329*).

ber 1971). Jalca de Cuchucuchu, 3900 m alt., heading up to the water intake of Huarmán, April 1971, C. *Ochoa 2985* (OCH). Lower levels of Cancha Uchucuna, 3650 m alt., facing Tacarpo (Jalcas de Huayán), 2 May 1972, C. *Ochoa 3307* (OCH). Jalcas de Purushcoto, 3900 m, heading up to the water intake of Huarmán, 2 May 1972, C. *Ochoa 3310* (OCH). Jalcas de Chaqui Cocha, 3975 alt., heading up from Sequipoquián to Huarmán, before the lagoon, plants robust, 2 May 1972, C. *Ochoa 3311*, 2n=24 (OCH). Near Cancha Uchucuna, 3600 m alt., heading up from Wuamanwillca toward Tacarpo, tubers long subcylindrical, moniliform, June 1977, C. *Ochoa 11699*, 2n=24 (OCH). Near the lagoon of Huarmán, 4200 m alt., above the water intake of Huarmán, heading up via Cotaparia, plants without flowers, plantlets and moniliform, fusiform or long subcylindrical tubers were collected, 22 April 1983, C. *Ochoa and A. Salas 15152*, 2n=24 (CIP, OCH, from the original plants, and CIP, GH, OCH, US, from plants grown at Huancayo). Heading down from the lagoon of Huarmán towards Tacarpo, 4000 m alt., in *jalca*, 22 April 1983, C. *Ochoa and A. Salas 15154* (CIP, OCH, US). Sequipoquián, 3900 m alt., between Wuamanwilca and the lagoon of Huarmán, 22 April 1983, C. *Ochoa 15157* (CIP, OCH). Near Cancha Uchucuna,

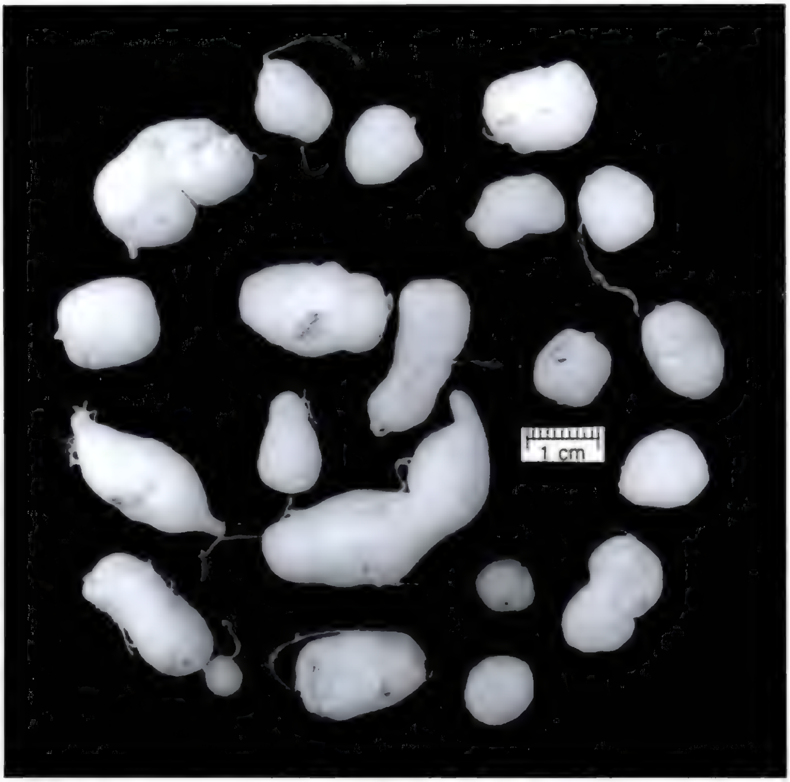


Figure 299. Tubers of *Solanum huarochiriense (Ochoa 11331).*

3500 m alt., between water intake of Huarmán and Tranca, tubers moniliform or long subcylindrical, 23 April 1983, *C. Ochoa and A. Salas 15163*, 2n=24 (CIP, GH, MOL, OCH, US). Cerro Ckellecuani or Romero Jata, 3800 m alt., east of Mallqui, along the footpath from Mallqui to Huarmán, 26 April 1983, C. *Ochoa 15190*, 2n=24 (CIP, MOL, OCH, US).

Province Bolognesi: Jalcas de Parana, 3900 m alt., above Camasichique, near Oncoy, only cuttings were collected, 20 March 1978, *C. Ochoa 12056*, 2n=24 (CIP, OCH, from plants propagated at Huancayo).

Province Huaraz: District Pampas, Cerro Canchón, 3800 m alt., in moist black soil in grassland, flowers sky-blue, 9 June 1983, *J. Espejo Ruiz 010* (OCH). Upper levels of Cerro Canchón, 3950 m alt., about 2 km from Chamlla, among large rocks, in moist black soil, 4 May 1984, *C. Ochoa, A. Salas and J. Espejo Ruiz 15735*, 2n=24 (CIP, OCH), and *15736*, 2n=24 (CIP, MOL, OCH, US).

Province Huaylas: Huascarán National Park, Quebrada Alpamayo at foot of snow-free peak above Lago Jancarurish (77° 41' W, 8° 53' S), 4350-4500 m, grassy slopes and bottoms on morainal material, parts appear to be frequently burned, clambering herb, rootstock hidden, flowers pale blue-purple, turning violet, anthers yellow, among large boulders, old talus slope, 9 March 1985, *D.N. Smith, R. Valencia and A. Gonzales 9770 p.p.* (MO, UNTC).

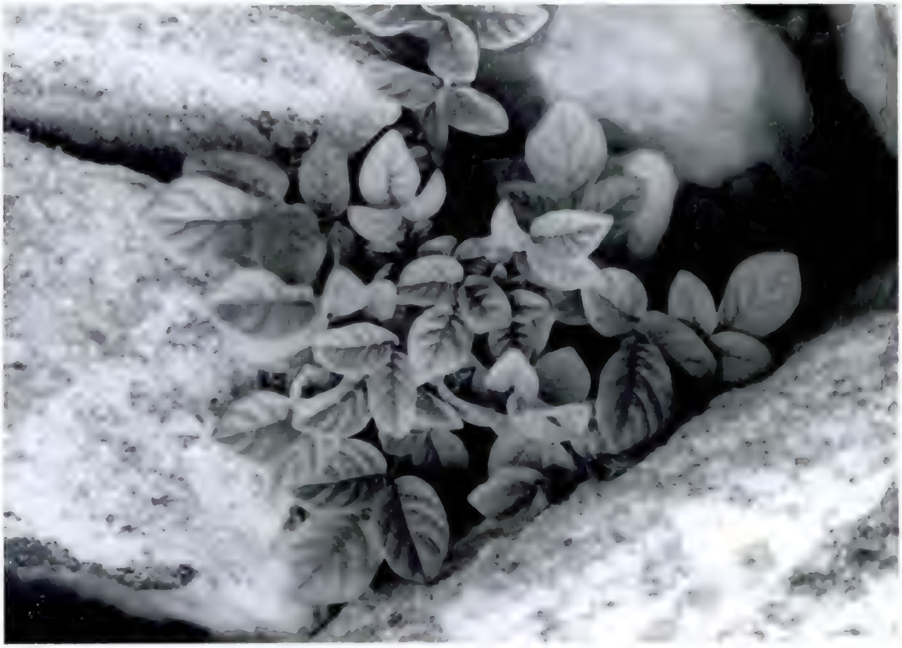


Figure 300. *Solanum huarochiriense* in its habitat and type locality, Pacomanta, Province Huarochirí, Lima, March 1982.

Department Lima

Province Canta: Lachaqui, Cerro Quinán, 4000 m alt., *puna*, rocky foothills, flowers violet, anthers orange-colored, n.v. *Papa de Añaz*, 30 June 1972, *G. Vilcapoma S. 67* (USM). Cerro Quinán, 4000 m alt., near Lachaqui, n.v. *Papa de Añaz*, among stones, 27 May 1973, *G. Vilcapoma S. 186* (OCH, USM). Lachaqui, Cerro Quinán, 4200 m alt., in *puna*, among stones, abundant, flowers lilac to purple, fruits globose, n.v. *Papa de Añaz*, 18 May 1974, *G. Vilcapoma S. 70* (GH, MO, MOL, OCH, US, USM), and *71* (OCH, USM). Lachaqui, rocky foothills of Cerro Chocororo, 3900 m alt., in grassland and among abundant plants of *Lupinus* sp., flowers lilac, tubers whitish-purple, n.v. *Papa de Añaz* (= *Opossum potato*), 18 May 1974, *G. Vilcapoma S. 230* (CIP, OCH, US, USM). Lachaqui, Cerro Quinán, 4000-4200 m alt., *puna*, rocky foothills, n.v. *Papa de Añaz*, flowers violet, anthers orange-colored, 18 May 1974, *G. Vilcapoma S. 231-A* (USM). Lachaqui, Cerro Quinán, 4000-4200 m alt., *puna*, among rocks, n.v. *Papa de Añaz*, flowers violet, anthers orange-colored, 18 May 1974, *G. Vilcapoma S. 231-B* (USM).

Province Huarochirí: Cerro Piño, 4240 m alt., north of Huarochirí, on mountain slope with grasses, flowers sky-blue, 10 May 1953, *E. Cerrate* and *O. Tovar 1802* (OCH, USM). Mountain crest between Santiago de Anchucayo and Tucto-Calachaca, 3900 m alt., flowers violet, on mountain slope, n.v. *Papa Claure*, 14 May 1953, *E. Cerrate* and *O. Tovar 1884* (OCH, USM). Mina Perdida, 4200 m alt., along the route Chumpicocha-Huarochirí, in *puna*, rocky, flowers light

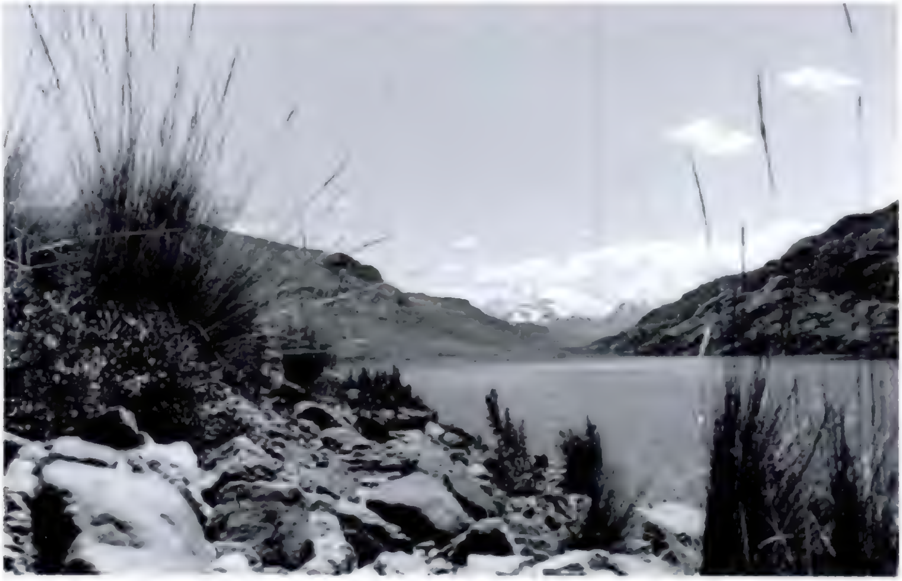


Figure 301. Habitat of *Solanum huarochiriense*, vicinity of Pariacaca, 4000-4200 m alt., Huarochirí, Lima.

blue, 29 May 1953, *E. Cerrate 2042* (OCH, USM). Pachacosa, 3750 m alt., near Aguacha, along the Lima-Huarochirí road, April 1960, *C. Ochoa 2308*, 2n=24 (CIP, MOL, OCH, US, USM, type collection of *S. huarochiriense*). Punas de Sheque, 4400 m alt., heading up to Marcapomacocha by the old route from Sheque to Casapalca, among stones, flowers lilac, March 1973, *C. Ochoa 3883* (OCH). Vicinity of Pachacosa, 3750 m alt., heading up via Aguacha, along the Lima-Huarochirí road, 15 April 1974, *C. Ochoa 5218* (OCH, topotype). Pacomanta, 3700-3800 m alt., between Langa and Huarochirí, heading up the highway route Lima-Sisicaya-Huarochirí, in *puna* grasslands, 15 April 1974, *C. Ochoa 5221* (MOL, OCH, USM). Near Escomarca, 3750 m alt., between Langa and Huarochirí, via Pacomanta, in rocky foothills, 21 March 1977, *C. Ochoa 11325* (CIP, GH, OCH). Between Pacomanta and Huarochirí, 3800 m alt., 21 March 1977, *C. Ochoa 11326*, 2n=24 (CIP, from plants propagated at La Molina, Lima, and OCH, from plants propagated in a field at Huancayo). Between Pacomanta and Huarochirí, 3850-3900 m alt., in *puna*, associated with *Stipa ichu*, 21 March 1977, *C. Ochoa 11329*, 2n=24 (CIP, OCH, US, USM, from plants propagated at Huancayo). Heading up from Pacomanta towards Huarochirí, 3950 m alt., 21 March 1977, *C. Ochoa 11331*, 2n=24 (CIP, OCH) and (OCH, from plants grown in a field at Huancayo). Near Huarochirí, 3900 m alt., along the route Huarochirí-Pacomanta, in foothills of a mountain, with *Stipa ichu*, 21 March 1977, *C. Ochoa 11334*, 2n=24 (CIP, OCH, from plants grown in the greenhouse at Huancayo, and OCH, from plants grown in a field at Huancayo). In *puna* near Huarochirí, 3950 m alt., among large rocks, 21 March 1977, *C. Ochoa 11335*, 2n=24 (CIP, MOL, OCH, plants grown from tubers in fields at Huancayo, and OCH, from plants grown in the greenhouse at La Molina, Lima). Near the Venturosa Mines, in large and very moist grasslands, 4000 m alt., abundant, produces tubers 8-10 mm in dia., white, leaves subvernicose, flowers pale lilac, February 1982, *C. Ochoa 14517*, 2n=24 (CIP, GH, OCH, US, propagated from plantlets at Huancayo, and OCH, from the original plants grown at La Molina, Lima). Near the Venturosa Mines, 4200 m alt., in grassland, associated with *Cajophora, Hypericum* and *Stipa ichu*, plants mostly small and some rosette-forming, 10-20 cm tall, 7 February 1982, *C. Ochoa and M. Orrillo 14525*, 2n=24 (CIP, GH, MOL, OCH, UNTC, US, USM). Near Pacomanta, 3790 m alt., leaves somewhat vernicose above, glabrous, plant very scarce, in *puna*, with *Stipa ichu*, March 1982, *C. Ochoa and M. Orrillo 14621*, 2n=24 (CIP, F, MOL, NY, OCH, US, USM). Near the Venturosa Mines, 4100-4200 m alt., in *puna*, 29 May 1982, *C. Ochoa 14824*, 2n=24 (CIP, GH, MOL, OCH, US). Vicinity of Condorpasa, 4200 m alt., between Marcapomacocha and Anticona Pass, only plantlets for reproduction were collected, 30 April 1983, *C. Ochoa 15193*, 2n=24 (CIP, MOL, OCH, US, from original plantlets propagated in the greenhouse at Huancayo).

Province Yauyos: Along the route from Laraos to Yauricocha, ca. 3800 m alt., summer 1995, Leg. *David Baumann s.n.* (OCH). Between Pamparca and Laraos, 3450 m alt., within forests of *quinuales* (*Polylepis* sp.), summer 1995, Leg. *David Baumann s.n.* (OCH).

Locality Indefinite: Viso, 2750 m alt., among rocks on wet slope, flowers lilac, 5 May 1922, *F. MacBride and Featherstone 594* (F).

Putative Natural Hybrids of *Solanum huarochiriense*

In the highlands of Aguacha and Pachacosa and along the Lima-Huarochiri road in the mountains above Matarachi and Pacomanta there occur certain natural hybrid populations of *S. huarochiriense* and *S. bukasovii*, two species that are typical of the *puna*. Usually, the dominant genes of *S. huarochiriense* are well expressed in these hybrids. For example, the leaves are less dissected than in *S. bukasovii* and the leaflets, which are broadly elliptic or elliptic-lanceolate, are more like those of *S. huarochiriense*. Moreover, the lilac or blue-lilac rotate corollas of these plants are like those of *S. huarochiriense*. However, other characteristics of these hybrids are more like those of *S. bukasovii*, including the rosette-forming habit and the greater overall pilosity of the plant, as well as the texture of the leaves, the calyx shape and the enlarged corolla. In all the individuals studied from these localities, as well as in the ones grown in the greenhouse and experimental field, the chromosome number was identical to that of the parental forms, i.e., 2n=24 chromosomes. The hybrids also produced very showy, ornamental flowers, very similar to the ones that developed on the F_1 plants that were obtained from artificial crosses between *S. huarochiriense* and *S. bukasovii*.

Specimens Examined

Department Lima

Province Huarochirí: Between Pachacosa and Huarochirí, 3750-3850 m alt., along the Lima-Huarochirí highway, a few km after Pachacosa, among large rocks and tufts of *Stipa ichu*, 21 March 1977, *C. Ochoa 11327*, 2n=24, only cuttings were collected (CIP, OCH, from plants propagated from original cuttings in the greenhouse at Huancayo), and *C. Ochoa 11328*, 2n=24 (CIP, OCH). Above Matarachi, 3000 m alt., heading up to Pacomanta along the Lima-Huarochirí highway, March 1982, *C. Ochoa 14612*, 2n=24, only plantlets were collected (CIP, F, NY, OCH, US, plants propagated in the experimental field at Huancayo from plants collected at the original type locality).

Breeding Potential

The results of crosses of *S. huarochiriense* (2n=24 and EBN=2) with diploid species of EBN=1 or EBN=2 and hexaploid species (2n=72) of EBN=4 are given in Table 74; whereas, the materials used in these experiments are shown in Table 75.

In the one series of reciprocal crosses that were made involving *S. huarochiriense* and a diploid species of EBN=1, namely the species *S. dolichocremastrum* of the Series Megistacroloba, success was attained only when *S. huarochiriense* was used as the pistillate parent.

Crosses involving plants having an EBN value of 2 gave mixed results. Large numbers of seeds were obained in reciprocal crosses involving *S. bukasovii* and *S. jalcae*, but in reciprocal crosses involving *S. chomatophilum*, a species which is considered morphologically to be very close to *S. huarochiriense*, only a very low average number of seeds were obtained in either direction. Moreover, reciprocal crosses involving *S. medians-2x* and *S. sogarandinum* were successful only when these two species were used as the pistillate parents. On the other hand, success was attained in all unilateral crosses involving *S. raphanifolium*, *S. megistacrolobum*, *S. multiinterruptum* and *S. goniocalyx*, but the amount of viable seed formed per berry for each species crossed was fairly low.

In the one Unilateral cross that was performed involving a hexaploid species of EBN=4, the species *S. albicans* of Series Acaulia, only an average of 7 seeds per berry were obtained, but these were subsequently found to be extremely fertile.

Some indication of the manner in which the genes of *S. huarochiriense* are expressed in interspecific crosses can be gleaned from the following descriptions:

Solanum huarochiriense (*OCH 14525*) × *S. chomatophilum* (*OCH 11856*)

The F_1 plants of this cross share many characters with *S. chomatophilum*. All are somewhat bushy in habit, and the stems are much-branched and of medium height (i.e., about 50-60 cm tall). The leaves have 4-5 pairs of leaflets and many interjected leaflets, while the flowers are fairly large (ca. 3 cm in dia.), light lilac or pale purple in color and are articulated near the base of the calyx. Overall, the leaves and flowers of these hybrids are very similar to those of *S. chomatophilum*.

Solanum huarochiriense (*OCH 14525*) × *S. dolichocremastrum* (*OCH 12072*)

The plants of this cross have many features in common with *S. dolichocremastrum*. The hybrids are vigorous, about 60 cm tall, with a cylindrical stem, and have leaves that are similar in shape and dissection to *S.*

dolichocremastrum. The crenulate-undulate leaflets of these hybrids are subsessile and narrowly decurrent about the rachis, while the corolla is pentagonal, lilac or purple and about 2.8 cm in dia. Pedicels are articulated about 8 mm below the base of the calyx. The strongly reflexed calyx lobes of these hybrids are elliptic-lanceolate in shape and are terminated by 2 mm long acumens. Only the absence of pubescence in these hybrids and the brilliancy of their leaflets reminds one of *S. huarochiriense*.

Solanum huarochiriense (OCH 14525) × *S. jalcae* (OCH 14785)

The plants of this cross have the dominant characteristics of *S. jalcae*. The leaflets are broadly winged or decurrent about the rachis and are dark green on the upper surface and purplish below. Moreover, the flowers are large, dark blue to very dark purple, and the calyx is like that of *S. jalcae* in being small and glabrous, with apiculate, broadly ovate lobes.

Table 74. Fertility of *Solanum huarochiriense* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	MEGISTACROLOBA	× *S. dolichocremastrum*	5(3)	2(1)	70(0)
24	2	CONICIBACCATA	× *S. chomatophilum*	21(20)	15(4)	5(18)
24	2	INGAEFOLIA	× *S. jalcae*	27(26)	23(15)	40(100)
24	2	MEGISTACROLOBA	× *S. megistacrolobum*	6	6	0
			× *S. megistalocrobum* var. *toralapanum*	10	1	20
			× *S. raphanifolium*	2	2	27
			× *S. sogarandinum*	18(11)	15(11)	0(75)
24	2	TUBEROSA	× *S. bukasovii*	69(36)	54(16)	168(133)
			× *S. goniocalyx*	9	3	10
			× *S. medians*-2x	3(14)	3(3)	0(78)
			× *S. multiinterruptum*	11	7	21
			× *S. phureja*	40	30	0
			× *S. saxatilis*	19(2)	13(2)	0(0)
72	4	ACAULIA	× *S. albicans*	17	15	7

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 75. Collections (OCH) used in *Solanum huarochiriense* fertility studies.

ACAULIA
S. albicans 12091

CONICIBACCATA
S. chomatophilum 11856, 13205, 13208, 14786, 14787, 14788

INGAEFOLIA
S. jalcae 13344, 14490, 14785

MEGISTACROLOBA
S. dolichocremastrum 12071, 12072
S. megistacrolobum 14272
S. megistacrolobum var. toralapanum 13544
S. raphanifolium 14323
S. sogarandinum 13006, 13324

TUBEROSA
S. bukasovii 11330, 11332, 11333, 13123, 13163, 13168, 13280, 13559, 14333, 15202
S. goniocalyx 00001
S. huarochiriense 11325, 11329, 11331, 11335, 14517, 14525, 15193
S. medians-2x 11637, 13185
S. multiinterruptum 11696, 14718
S. phureja 15071, 15130, 15136, 15290, 15326, 15332
S. saxatilis 15082

63. *Solanum immite* Dun. in DC., Prodr. 13(1): 32, 1852.

Figs. 302-304; Map 24; Plate XXIX.

S. tuberosum var. *multijugum* Hook. f., Fl. Antarct. 2:330, 1847.
S. mathewsii Bitt., Fedde Repert. Sp. Nov. 12:53-54, 1913.

Plant erect, slender, (20-)30-40(-50) cm tall, essentially glabrous or very slightly pilose on the veins and veinlets of the lower side of the leaflets, with a few short glandular hairs on the terminal and axillary portions. Stem simple or branched, cylindrical, slender, (2-)3-5 mm in dia. at base, light green with a tinge of pigment at base and in the leaf axils, internodes to 3.5 cm long. Plant stoloniferous and tuber-bearing, stolons to 60 cm or more long, slender, 1.5-2.0 mm in dia., white; tubers globose, white or milky-white, small, 1-2 cm long (Fig. 304). Leaves slightly vernicose above, imparipinnate, (6-)12-15(-20) cm long by (3-)8-12(-16) cm wide, with (3-)4-5 pairs of lateral leaflets and (0-)1-3 pairs of interjected leaflets; leaflets narrowly elliptic-lanceolate or lanceolate, apex subacuminate or slightly acuminate, base obliquely rounded, on petiolules 2.5-10.0(-17.0) mm long, very rarely with subcrenulate margins; terminal leaflet (2.2-)3.5-7.5 cm long by (0.6-)1.4-2.8 cm wide, nearly of the same size or slightly larger than the laterals, except for the lowermost pair, which is considerably smaller.

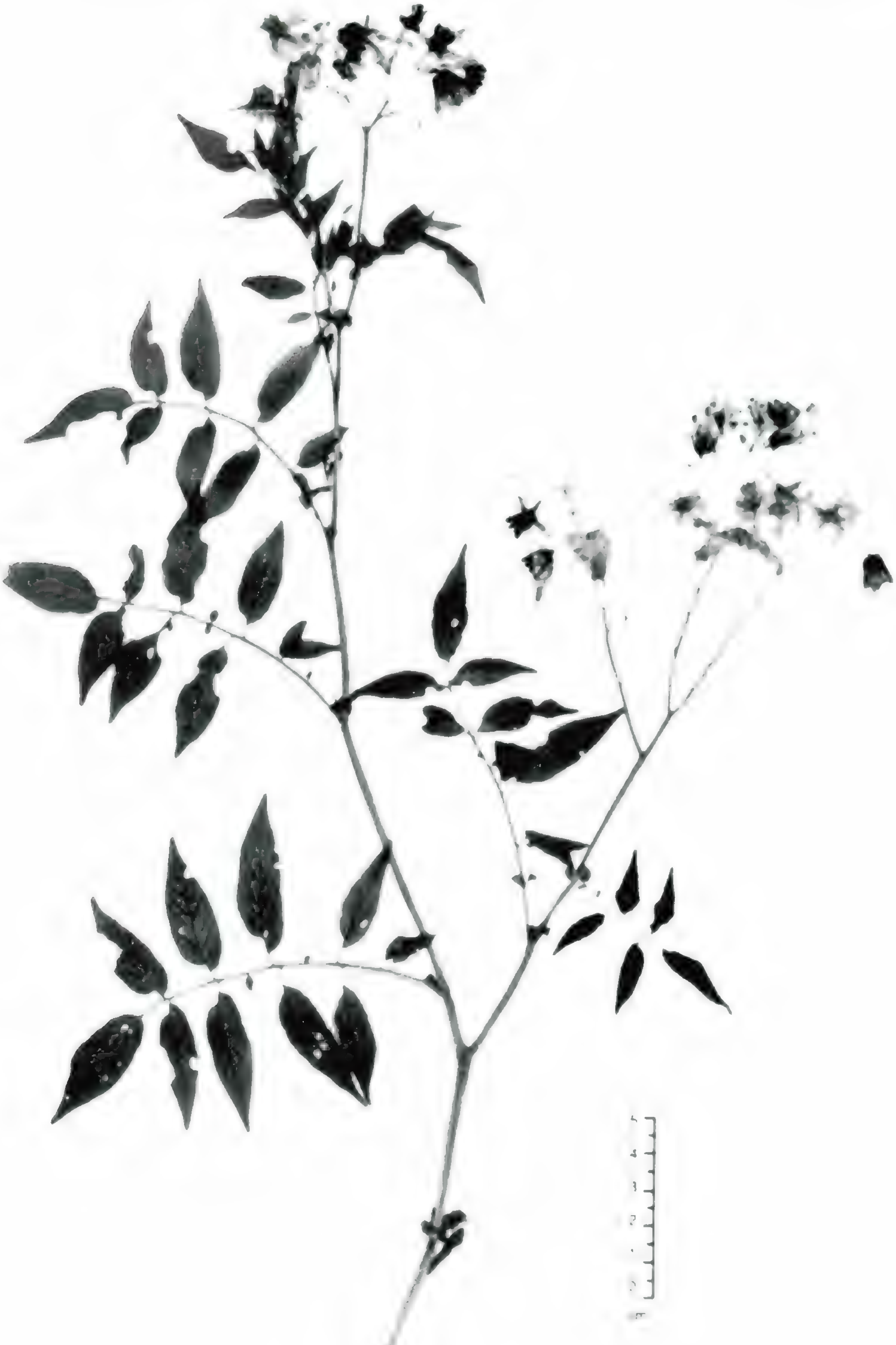


Figure 302. *Solanum immite* (*Ochoa 15184*).

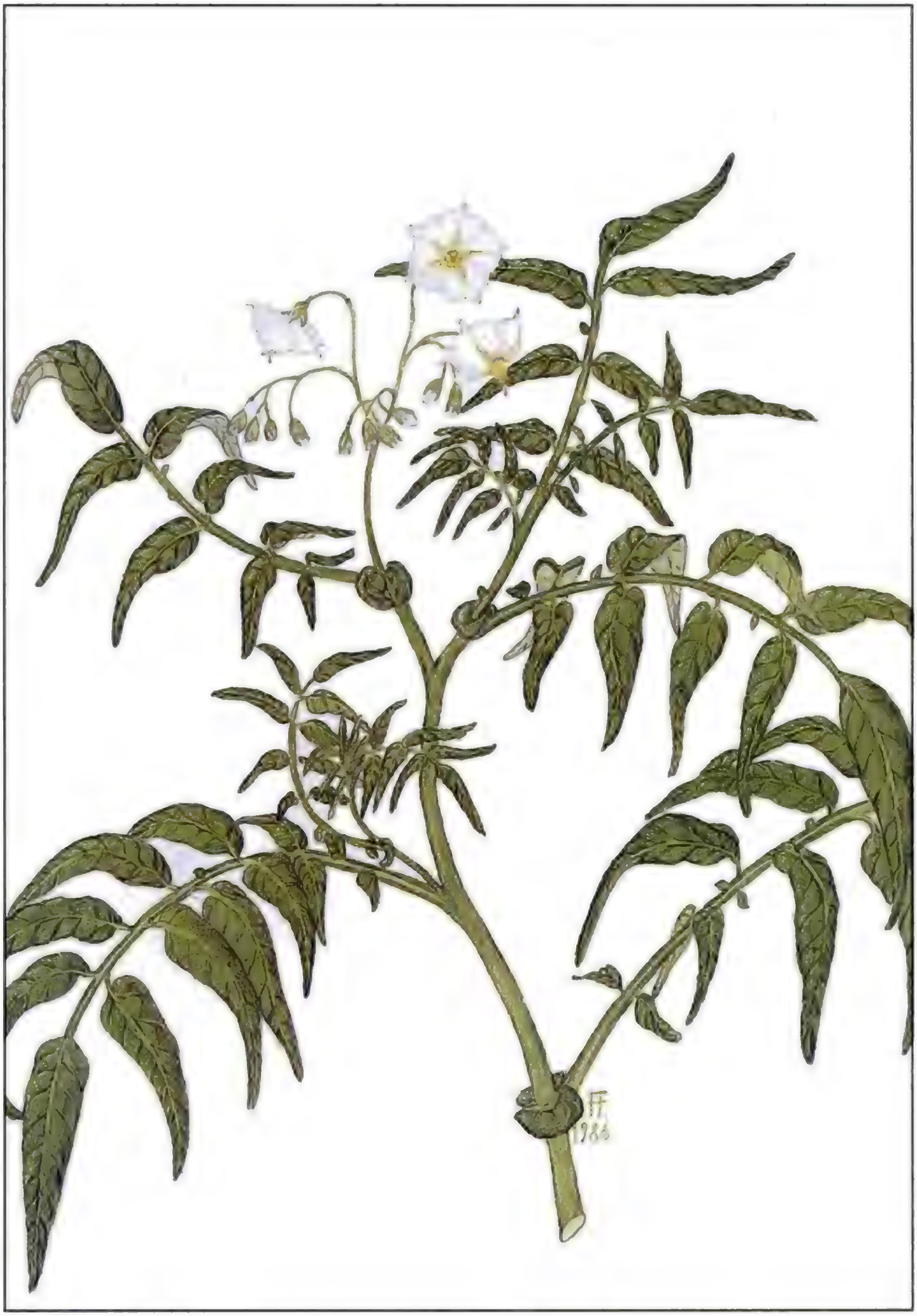


Plate XXIX. *Solanum immite* Dun.

Pseudostipular leaves narrowly falcate, 5-8(-10) mm long by 2.5-3.0(-5.0) mm wide. Inflorescence terminal and lateral, cymose or cymose-paniculate, (5-7-)12-20 flowered; peduncle 2.0-6.0(-8.5) cm long; pedicels very slender, 2.5-3.5 cm long, articulated near or slightly below the midpoint. Calyx small, 4-5 mm long, symmetrical; lobes broadly ovate, apex abruptly acuminate, acumens very short, 0.5-1.0 mm. Corolla rotate, white, 2.7-3.0 cm in dia. (Fig. 303). Anthers oblong-lanceolate to lanceolate, 4.5-5.8 mm long; filaments 1-2 mm long, white, glabrous. Style (7.5-)8.0-9.0(-10.0) mm long, densely papillose along the basal two-thirds of its length; stigma subglobose or claviform, cleft. Fruit round to oblong, light green, nearly 1 cm long, usually wrapped with remnants of the corolla (Fig. 304). Chromosome Number: 2n=24. EBN=1.

Type: PERU. Department Lima, Province Huaral, "Hab. *in Collibus Chancay*, Potatoes of Peru," 1778-1788, *H. Ruiz* and *J. Pavón 8/90 p.p.* (G, MA and MA p.p., type collection of *S. immite*).

The type collection of *S. immite* was most likely collected by the Spanish explorers Hipólito Ruiz and José Pavón during their first field trip to Chancay, north of Lima. They spent the greater amount of their time botanizing in the company of their French collaborator, José Dombey from the end of June to the end of August, 1778. A second botanical collecting trip to Chancay and Huaura was made without Dombey, from July to September, 1780. This last trip was made principally for the recovery of the supposed loss of their collections suffered in the capture of the Spanish navy ship *Buen Consejo* by the British. Dombey had arranged to ship all of their first Chancay collections back to France and Spain aboard this ship. However, the *Buen Consejo* was ransomed back by the Spaniards in Lisbon, where the English had put it up for sale, and the Ruiz and Pavón specimens were later salvaged.

In August 1987, the author discovered two sheets of the original collections of Ruiz and Pavón in a chest marked #275 (A-N) of the herbarium "Horti Botanici Matritensis Herbarium Peruvianum Ruiz et Pavón." One sheet had but a single plant specimen (MA 8/90) of *S. immite* mounted on it, while the other sheet consisted of two specimens (MA 8/90 p.p.), one corresponding to *S. immite* (Plant 1) and the other to *S. medians* (Plant 2). Another specimen belonging to the type collection of *S. immite* was examined by the author at the Herbarium of the Conservatory and Botanical Garden at Geneve (G), Switzerland. All carried labels of identification indicating that they came originally from Chancay, Peru.

Affinities

This species stands alone in its morphological characteristics. Its leaves are unlike any other tuber-bearing species in having a very fine, smooth texture and in having very slender, acuminate-lanceolate leaflets. Moreover, the berries are unusual in that they remain covered with the remnants of the corolla during their entire period of maturation.

Habitat and Distribution

Contrary to what has been previously believed, *S. immite* is not only a species of the sandy, coastal loma formations of central Peru, but also an inhabitant of the low, cisandean sierras, from latitude 8° to 12° S. It grows in soils of diverse physical composition, from mixtures of sand and gravel to deposits of sand on clay. Altitudinally, this species ranges from sea level to 80 m at the Lomas de Supe in the Province of Barranca, Lima, to 2500 m in the mountains near Cotup and Chullurccoto, Province of Aija, Ancash (Map 24). Thus, its period of growth correlates not only with the development of the loma vegetation along the coast (principally May through October), but also with the onset and duration of the rainy season in the sierra (December through April). In the more subxerophytic areas of its range, as for example in the quebradas at Casmiche and San Chicón in the Samne River basin, this species is associated with bromeliads, columnar cacti, *Lycopersicon hirsutum*, *Calceolaria*, *Begonia*, *Puya*, *Verbena*, *Lantana*, *Bidens* and other herbs.

Specimens Examined

Department Ancash

Province Aija: Cotup, 2500 m alt., between Chullurccoto and Huasparón, along the horse trail from San Miguel to Huayán, May 1966, C. *Ochoa 2611* (OCH). Yuncapampa, 2000 m alt., between Aguada de Monsalve and Ushpaccata, along the horse trail from San Miguel to Huayán, April 1971, C. *Ochoa 2965* (OCH). Cotup, ca. 2400 m alt., along the horse trail from San Miguel to Huayán, 19 June 1977, C. *Ochoa 11689*, 2n=24 (CIP, MOL, OCH, UNTC, USM). Ushpaccata, 2600 m alt., between Huayán and Aldave, along the horse trail from San Miguel to Huayán, 24 April 1983, C. *Ochoa 15184,* 2n=24 (CIP, GH, MOL, OCH, US).

Department La Libertad

Province Otuzco: Lower slopes of Cerro San Chicón, 2500-2650 m alt., along the Trujillo-Otuzco road, near km 66, among large rocks and xerophytic

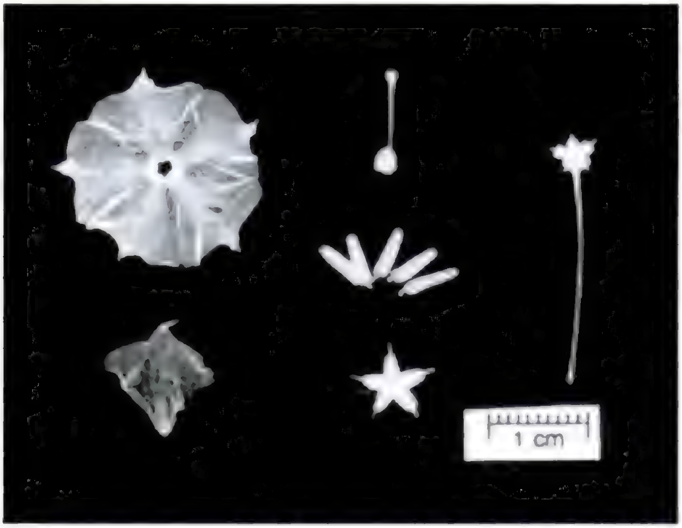


Figure 303. Floral dissection of *Solanum immite* (*Ochoa 11689*).

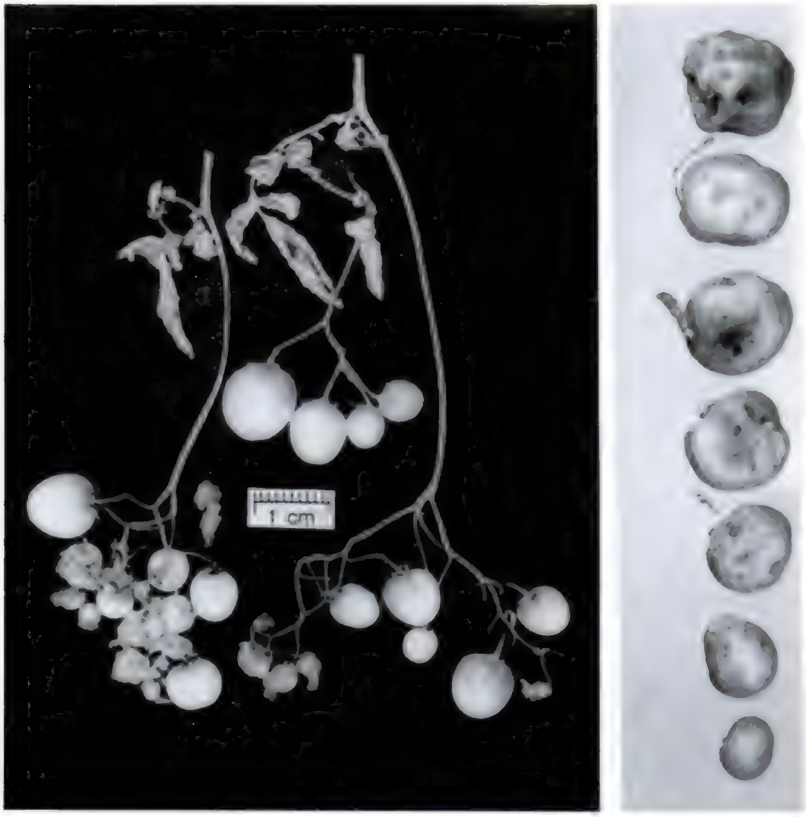


Figure 304. Berries and tubers of *Solanum immite* (*Ochoa 14261*). Notice the corolla persisting on the immature fruits.

plants, cactus and bromeliads, n.v. *Fox Potato*, 10 May 1952, *C. Ochoa 1423* (OCH), 21 April 1960, *C. Ochoa 2303* (CIP, MOL, OCH, UNTC, US, USM), and 24 March 1964, *C. Ochoa and J.G. Hawkes 2550* (OCH). Casmiche, 1890 m alt., along the Trujillo-Otuzco road, 2000 m alt., with *Calceolaria, Begonia, Puya, Verbena, Bidens* and many bromeliads and cacti, 30 April 1979, *C. Ochoa 13282* (CIP, OCH). Between Casmiche and San Chicón, ca. 2100 m alt., along the Trujillo-Otuzco road, in full flower and fruit, on rocky subxerophytic talus slopes, 9 May 1979, *C. Ochoa 13346*, 2n=24 (OCH). Qebrada de Pichullo, above Casmiche, 2000-2100 m alt., tubers very small, 1-2 cm, white, ovoid and round, 8 July 1981, *C. Ochoa 14491*, 2n=24 (CIP, OCH plants grown at Huancayo from the original tubers). Below Piedra Gorda (Salpo-Samne road), 2550 m alt., 5 June 1992, *S. Leiva, P. Leiva and N. Leiva 544* (MO).

Province Trujillo: Cerro de La Pileta, 450 m alt., Lomas de Virú, in sandy soil, plants tuber-bearing, small, 25-30 cm tall, white flowered, 9 November 1952, *C. Ochoa 1812* (OCH). Lomas de Virú, 400 m alt., 19 August 1961, *A. Sagástegui e I. Sánchez 3640* (HUT).

Department Lima

Province Barranca: Lomas in the vicinity of Supe, 100 m alt., October 1970, *C. Ochoa 2879* (OCH).

Province Canta: Cuesta de Purruchuca [Puruchuco], April 1832, *A. Mathews 771 p.p.* (CGE, E, GL, K, L, OXF, type collection of *Solanum mathewsii*). Cuesta de Puruchuco, heading up by way of Cuesta Colorada toward Puruchuco, 1800 m alt., in foothills of a sandy-clay mountain and in red-clay soil, 11 April 1960, *C. Ochoa 2293* (MOL, OCH, topotype of "*Solanum mathewsii*"). Tararacra, 1700 m alt., heading up the Cuesta de Purucho by foot toward Puruchuco, before coming to the rest area of Cuesta Colorada, 21 March 1971, *C. Ochoa 2962* (MOL, OCH, US). Puruchuco, ca. 2000 m alt., among stones, herb with white flowers and nearly globose berries, pale green with dark green stripes, in full fruit, 9 May 1974, *G. Vilcapoma 229* (MOL, OCH). Puruchuco, 2350 m alt., in the road toward Apán, on rocky hillsides, mountain *caducifolio*, flowers white, 2 April 1994, *R. Moreyra and G. Vilcapoma 3045* (MOL, OCH).

Province Huaral: Chancay, "Potatoes of Peru," 1778-1788, *H. Ruiz* and *J. Pavón 8/90 p.p.* (G, MA, type collection of *Solanum immite*). Lomas de Chancay, 200-250 m alt., on a rocky hill, flowers white, 24 September 1952, *R. Ferreyra 8718* (topotype USM). Lomas de Lachay, 200 m alt., 11 August 1971, *Z. Huamán 237* (CIP, OCH) and *237A* (CIP, OCH). Lomas de Lachay, 200 m alt., September 1980, *C. Ochoa 14871* (CIP, GH, MOL, OCH, US, plants grown at La Molina, Lima, from the original plantlets). Naupay, 2400 m alt., Chancay, flowers white, n.v. *Fox Potato*, 23 March 1975, *E. Cerrate, M. Chanco and G. Vilcapoma 260* (OCH, USM).

Province Huarochirí: Before Langa, 1800 m alt., heading up the highway Lima-Huarochirí, via Sisicaya, toward Huarochirí, on rocky talus slopes, white flowers with very light lilac stripes on the acumens, March 1982, *C. Ochoa 14607* (OCH, US).

Breeding Potential

The results of crosses of *S. immite* (2n=24 and EBN=1) with diploid species of EBN=1 or EBN=2 are given in Table 76, while the materials used in these experiments are shown in Table 77.

Success was attained in reciprocal crosses involving this species and *S. mochiquense*, *S. chancayense* and *S. hypacrarthrum*. Unilateral crosses involving *S. wittmackii* were also successful, but yielded only a low average number of seeds per berry. Moreover, reciprocal crosses involving *S. chomatophilum* and *S. medians-2x* (both EBN=2) were successful only when these two species were used as the pistillate parents, although, in both cases, the amount of seed set was not very high.

Table 76. Fertility of *Solanum immite* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	PIURANA	× *S. hypacrarthrum*	9(11)	4(9)	7(49)
24	1	SIMPLICISSIMA	× *S. simplicissimum*	7	6	0
24	1	TUBEROSA	× *S. chancayense*	10(12)	6(7)	52(19)
			× *S. incahuasinum*	13(14)	11(6)	11(36)
			× *S. mochiquense*	23(21)	18(11)	70(130)
			× *S. wittmackii*	8	2	10
24	2	CONICIBACCATA	× *S. chomatophilum*	29(13)	11(7)	0(71)
			× *S. limbaniense*	4(12)	4(8)	0(0)
24	2	MEGISTACROLOBA	× *S. sogarandinum*	5(7)	1(0)	0(0)
24	2	PIURANA	× *S. cantense*	17	12	0
			× *S. chiquidenum*	5	5	0
24	2	TUBEROSA	× *S. bukasovii*	17(23)	13(11)	0(0)

× *S. goniocalyx*	3	2	0
× *S. marinasense*	4(9)	3(0)	0(0)
× *S. medians*-2x	4(23)	2(11)	0(13)
× *S. multiinterruptum*	27(5)	21(0)	0(0)
× *S. tacnaense*	11(5)	9(4)	0(0)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 77. Collections (OCH) used in *Solanum immite* fertility studies.

CONICIBACCATA
S. chomatophilum 11061, 11755
S. limbaniense 14291

MEGISTACROLOBA
S. sogarandinum 13336

PIURANA
S. cantense 14681
S. chiquidenum 11059
S. hypacrarthrum 11308, 13272

SIMPLICISSIMA
S. simplicissimum 15147

TUBEROSA
S. bukasovii 13559, 14333, 14381, 15198
S. chancayense 11250
S. goniocalyx 00001
S. immite 11689, 13346, 14491, 15184
S. incahuasinum 11613
S. marinasense 15687
S. medians-2x 11259, 11637, 13185
S. mochiquense 14820, 14870, 15995
S. multiinterruptum 12053, 12057, 14718
S. tacnaense 11611
S. wittmackii 10983

63a. *Solanum immite* Dun. var. *vernale* Corr., Wrightia 2:181, 1961.

Fig. 305; Map 24.

Variety *vernale* is distinguished from the typical variety of this species by its more robust habit and the greater segmentation of its leaves. An examination of the many specimens of this variety from its type locality also shows a number of other important differences, including the presence of larger and more broadly elliptic-lanceolate leaflets, these having a longer, and more acuminate apex than in the typical variety.

As in the case of *S. medians*, *S. wittmackii* and *S. mochiquense*, this species can be found only during the brief rainy season that occurs along the central coast and in the neighboring sierras.

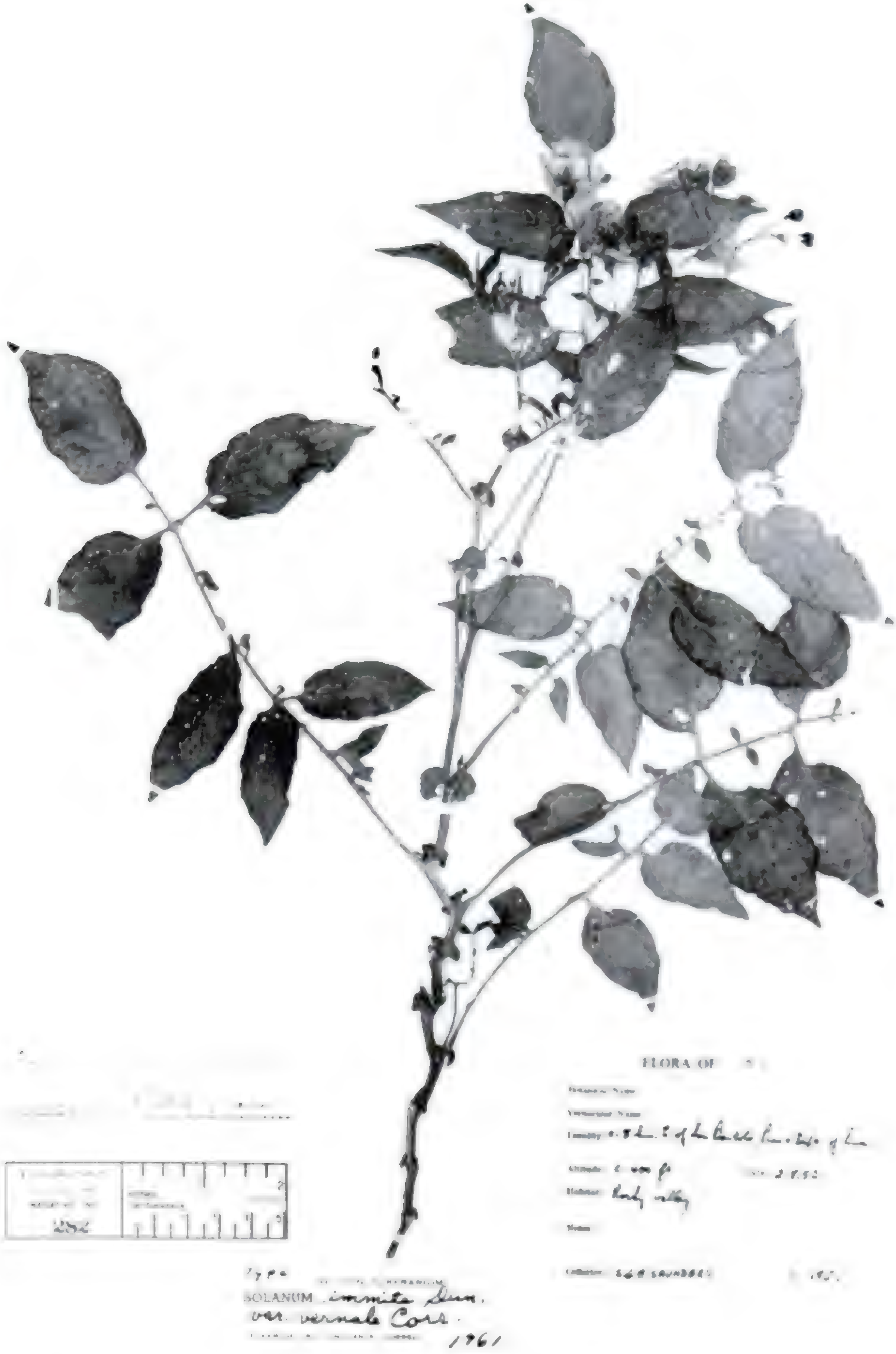


Figure 305. *Solanum immite* var. *vernale* (*Saunders-185*, type collection).

Specimens Examined

Department Lima

Province Lima: In a rocky valley, about 8 km east of San Bartolo, ca. 120 m alt., 2 August 1953, *S. C. E. Saunders 185* (BM, type of *Solanum immite* var. *vernale*). Lomas de Caringa, 9 km east of San Bartolo, 300 m alt., on talus slopes among rocks, 21 August 1971, *C. Ochoa 3038* (F, OCH, topotype of *Solanum immite* var. *vernale*). Lomas de Cerro Grande, 480 m alt., near the Lomas de Caringa and about 10 km east of San Bartolo, among large rocks, 21 August 1971, *C. Ochoa 3039* (OCH).

64. *Solanum incahuasinum* Ochoa, Kurtziana, 12-13:183-185, 1979.

Figs. 306-307; Map 26.

Plant herbaceous, tuber-bearing, 60-70 cm tall. Stem erect, usually simple, 6-8 mm in dia. at base, light green and puberulent, wings very narrow, straight or sinuous in the upper one-third of the stem, scarcely distinguishable along the lower half of the stem; internodes (3.0-)4.5-6.0(-7.0) cm long; stolons (40-)70-90(-120) cm long; tubers ovoid to oval-flattened or long flattened pyriform, 5-6 cm long, white, conspicuously lenticulate, lenticels large, 2-3 mm in dia., buds white, exceptionally vigorous, subcylindrical or slightly bulbous at base, pubescent. Leaves imparipinnate, 14.5-22.0 cm long by 8.0-13.5 cm wide, little divided, with 2-3 pairs of leaflets, usually without interjected leaflets or, when present, with 1-2 very small pairs, glabrous above, except for the puberulent rachis, and sparsely puberulent below. Terminal leaflet larger to much larger than the laterals, 10-13 cm long by 4.8-6.5 cm wide, ovate-lanceolate or narrowly elliptic-lanceolate, apex pointed or shortly acuminate, base rounded to cuneate; leaflets of the first upper pair 5.5-7.0 cm long by 2.5-3.3 cm wide, very shortly petiolulate or sessile and narrowly decurrent about the rachis. Leaflet margins finely and irregularly crenulate. Pseudostipular leaves broadly falcate or subfalcate, 6-12 mm long by 3-7 mm wide. Inflorescence cymose, (10-)15-20-flowered; peduncle short, 1.5-3.5 cm long, puberulent; pedicels (2.5-)3.0-4.0 cm long, articulated at the midpoint or slightly above center. Calyx symmetrical or asymmetrical, small, 4.5-5.0 mm long, glabrous, light green as in the case of the pedicels and peduncles, lobes broadly elliptic-lanceolate, the apex apiculate or finely acuminate, acumens filiform, 1 mm long. Corolla rotate or rotate-pentagonal, white, showy, large, (4.0-)5.0-5.5 cm in dia. (Fig. 307), with a white-hyalinous internal star, lobes (8-)10-12 mm long, up to 25 mm wide, acumens short, 2.0-2.5 mm, with a broad base and finely narrowing apex, nearly cuspidate, puberu-

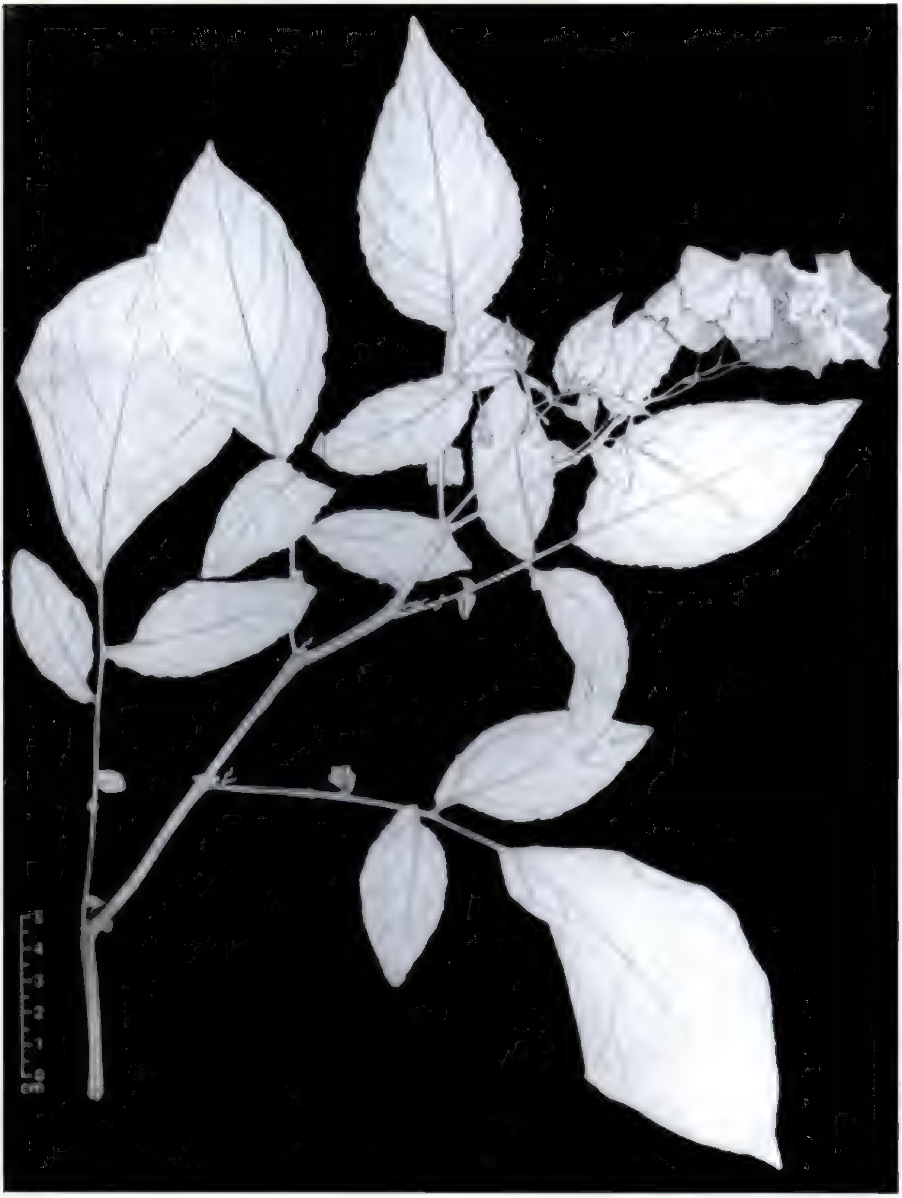


Figure 306. *Solanum incahuasinum* (*Ochoa 3595*, holotype).

lent and somewhat cuculate. Anther column cylindric-conical, anthers narrowly lanceolate, long, 6.5-7.0 mm long by 1.2-1.5 mm wide at base, sublobulate, filaments up to 2 mm long, glabrous, white-hyalinous. Style 11-12(-13) mm long, exerted 2.8-3.5 mm, papillose along the basal one-third of its length; stigma capitate, cleft, less than 1 mm in dia. Ovary oval-pyriform or pyriform. Fruits globose to ovoid-pyriform, light green, 15-20 mm long. Chromosome Number: 2n=24. EBN=1.

Local Name: *Papa de Zorro* (Fox Potato)

Type: PERU. Department Lambayeque, Province Ferreñafe, District of Incahuasi, Qebrada de Rumichaca, 2875 m alt., north of El Rejo, February 1973, *C. Ochoa 3595* (holotype OCH, isotype MOL).

Affinities

This species is very closely related to *S. mochiquense*. Both species have leaflets with irregularly crenulate margins, white corollas, large anthers, small calyces, pedicels articulated about the midpoint and similarly colored and shaped berries. However, *S. incahuasinum* differs in having much larger flowers, corollas that tend toward being more rotate-pentagonal and very small calyces that vary from symmetrical to slightly asymmetrical. Also, these two species differ greatly with respect to leaf shape and dissection. The leaves of *S. incahuasinum* have few pairs of leaflets and are usually without interjected leaflets, while the terminal leaflets

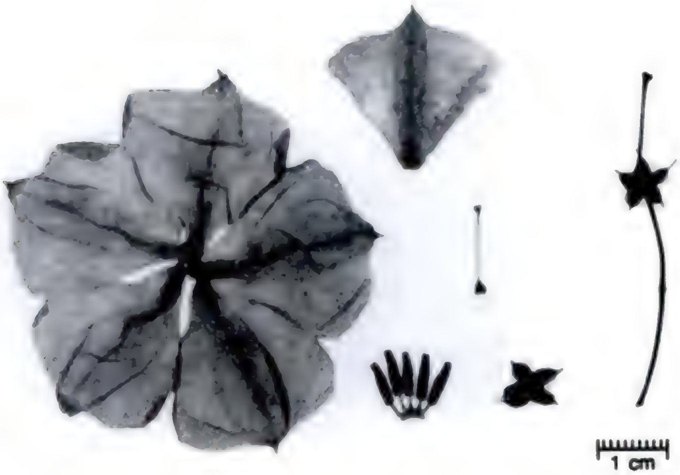


Figure 307. Floral dissection of *Solanum incahuasinum* (*Ochoa 11613*).

are ovate-lanceolate and conspicuously larger than the laterals; whereas, in *S. mochiquense*, the leaves are much divided with many interjects, and the terminal leaflet is broadly elliptic-lanceolate and almost of the same size as the laterals.

Although closely related to *S. mochiquense, S. incahuasinum* is also similar in some ways to the white flowered species, *S. chancayense*. However, it differs from that species in having larger corollas that tend towards being more rotate-pentagonal in shape, as well as in the shape and size of the calyx and in the color and form of the fruits.

Habitat and Distribution

This species grows in moist thickets of trees and shrubs in quebradas and on the slopes of mountain foothills at elevations ranging between 2500 and 2800 m altitude.

As far as is presently known, S. incahuasinum is endemic to the mountains in the Province of Ferreñafe, Department of Lambayeque (Map 26).

Specimens Examined

Department Lambayeque

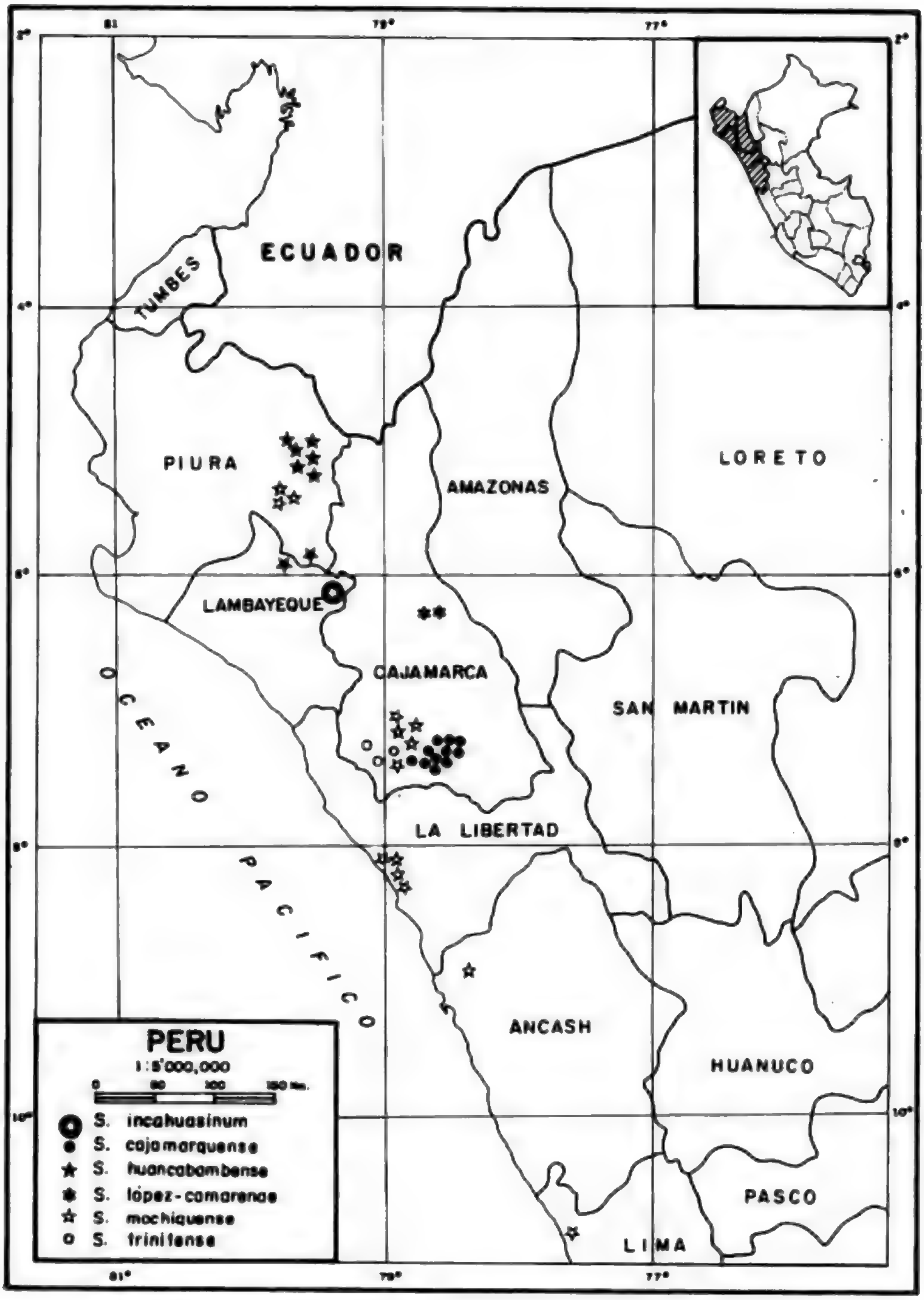
Province Ferreñafe, District Incahuasi: Quebrada de Rumichaca, 2875 m alt., north of El Rejo, February 1973, C. *Ochoa 3595* (OCH, MOL, type collection of *S. incahuasinum*). Amangay, 2500 m alt., near Moyano, 13 April 1977, C. *Ochoa 11613*, 2n=24 (CIP, OCH).

Breeding Potential

The results of crosses of *S. incahuasinum* with diploid species of EBN=1 or EBN=2 are given in Table 78, while the materials used in these experiments are shown in Table 79.

As might be expected in crosses involving species having the same chromosome numbers and EBN values, a large number of fertile seeds were obtained in reciprocal crosses of *S. incahuasinum* with *S. chancayense* or *S. mochiquense*. Similarly, unilateral crosses involving other species of identical ploidy and EBN levels, such as *S. lignicaule*, *S. hypacrarthrum* and *S. wittmackii*, were remarkably successful, even though these plants came from three different taxonomic series. However, note that while *S. immite* (a species which grows sympatrically with *S. chancayense*) is compatible with S. *incahuasinum*, the average numbers of seeds that were obtained in such crosses was rather low.

Usually few seeds were obtained in crosses involving plants of EBN=2.



Map 26. Distribution of *S. incahuasinum*, *S. cajamarquense*, *S. huancabambense*, *S. lopez-camarenae*, *S. mochiquense* and *S. trinitense*.

Such was the case, for example, in reciprocal crosses involving *S. multiinterruptum* and *S. huancabambense*, and in unilateral crosses involving *S. tacnaense*, *S. phureja* and *S. medians-2x*.

Table 78. Fertility of *Solanum incahuasinum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	LIGNICAULIA	× *S. lignicaule*	15	11	154
24	1	PIURANA	× *S. hypacrarthrum*	8	3	125
24	1	TUBEROSA	× *S. chancayense*	32(29)	25(22)	146(136)
			× *S. immite*	14(13)	6(11)	36(11)
			× *S. mochiquense*	20(32)	20(29)	99(176)
			× *S. wittmackii*	15	12	134
24	2	CONICIBACCATA	× *S. rhombilanceolatum*	7	1	0
24	2	PIURANA	× *S. cantense*	6	3	0
24	2	TUBEROSA	× *S. huancabambense*	8(29)	5(11)	2(24)
			× *S. medians-2x*	7	4	9
			× *S. multiinterruptum*	21(1)	15(1)	16(5)
			× *S. phureja*	50	28	10
			× *S. tacnaense*	12	9	23

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 79. Collections (OCH) used in *Solanum incahuasinum* fertility studies.

CONICIBACCATA
S. rhombilanceolatum 14406

LIGNICAULIA
S. lignicaule 14416

PIURANA
S. cantense 14681
S. hypacrarthrum 11308

TUBEROSA
S. chancayense 11250
S. huancabambense 11619
S. immite 11689, 14870
S. incahuasinum 11613
S. medians-2x 11884
S. mochiquense 14820, 14870
S. multiinterruptum 11690, 11693, 11694, 14718
S. phureja 5186, 5189, 13896, 13909, Bulk phu
S. tacnaense 11610
S. wittmackii 11877

65. *Solanum incasicum* Ochoa, Phytologia 48(3):229-232, illustr., 1981.

Fig. 308; Map 23.

Plant vigorous, erect, 50-60 cm tall, pubescent; stem simple or branched, 6-8 mm in dia. at base, wings straight, narrow, light green, densely pilose, hairs white, multicellular, 3-4 mm or more long, pigmented deep purple in the basal one-third of its length; internodes (1.5-)3.0-5.0 cm long. Stolons up to 1 m or more long by 2 mm in dia., white, fleshy; tubers white, round to ovoid, 1-3 cm long. Leaves imparipinnate, very divided, (6.5-)10.5-13.0 cm long by (4.5-)7.5-9.7 cm wide, densely pilose, including the rachis, petioles and petiolules, with 3-4 pairs of leaflets and 2-4 pairs of interjected leaflets of diverse size; petioles 5-10 mm long. Leaflets narrowly elliptic-lanceolate or elliptic-lanceolate, densely covered with short hairs, silvery-white above and pubescent below, especially on the veins and veinlets, leaflet margins somewhat wavy to subcrenulate, densely pubescent. Terminal leaflet slightly larger than the laterals of the first adjacent pair, 3.5-5.5 cm long by 2-3 cm wide, apex pointed to subacuminate, base rounded; apex of the lateral leaflets pointed to subobtuse, base obtuse to obliquely rounded and shortly petiolulate, the first pair of lateral leaflets 2.2-5.0 cm long by 1-2 cm wide, the following pairs gradually diminishing in size toward the base. Interjected leaflets orbicular, ovate or broadly elliptic-lanceolate, sessile, small, 1-6 mm long. Pseudostipular leaves small, 5-7 mm long by 3-4 mm wide, narrow and obliquely elliptic-lanceolate to subfalcate. Inflorescence cymose to cymose-paniculate, 10-12-flowered; peduncle 5-10 cm long, vigorous, up to 2.5 mm in dia. at the base, densely pilose as in the case of the pedicels and the calyx; pedicels 20-25(-30) mm long, articulated in the upper one-third of their length or 6 mm or less below the base of the calyx. Calyx symmetrical, 10-11 mm long, pigmented or only slightly so, lobes narrowly lanceolate and broadly scarious, abruptly narrowed to pointed, 3-4 mm long acumens. Corolla rotate, large, up to 4.5 cm in dia., very showy, dark lilac with a grayish-white or glassy-white internal star. Anther column subcylindric-conical, asymmetric, anthers narrowly lanceolate, 6.0-6.5 mm long, base cordate; filaments 1.5-2.5 mm long, white-hyalinous, glabrous. Style 11 mm long, exerted 2.5 mm, densely papillose along the basal one-third of its length; stigma capitate, large, cleft; ovary pyriform. Fruit ovoid, nearly round, 3 cm long by 2.2 cm in dia. at base, dark green with dark purple vertical stripes and sprinkled with small white dots. Chromosome Number: 2n=24. EBN=2.

Type: PERU. Department Cusco, Province Urubamba, facing the Pacaymayo River, 3900 m alt., near stately ruins of Inca architecture, in moist relic forests, March 1973, C. *Ochoa 4001* (holotype OCH, isotype LE).

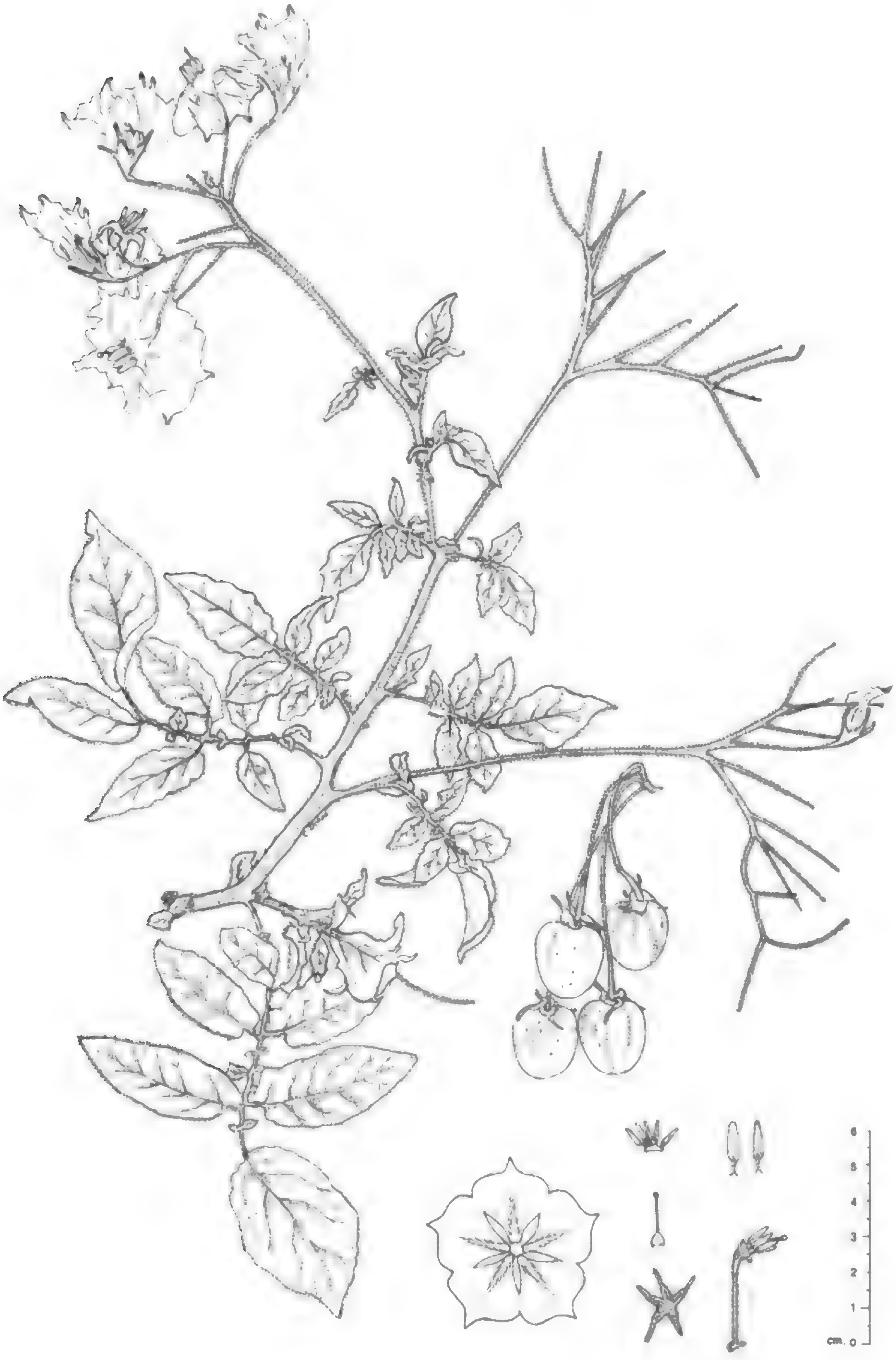


Figure 308. *Solanum incasicum* (*Ochoa 4001*, holotype).

Affinities

Although *S. incasicum* is related to *S. coelestispetalum*, it differs from that species in having a conspicuous and very densely silvery-white pubescence that covers the whole plant and in having ovoid rather than globular-shaped fruits and more narrowly elliptic-lanceolate leaflets with sinuate-crenulate margins. Moreover, the leaves of this species have more numerous interjected leaflets, and the rotate corollas are lilac-colored.

Habitat and Distribution

Solanum incasicum is a member of the *Ceja de Montaña*, a cool and very foggy mountainous region of Peru. Within this region it grows in the moist soils of relic forest stands of trees and shrubs.

This species is very rare. It is currently known from only two collections made in the Province of Urubamba, Department of Cusco, in southern Peru (Map 23).

Specimens Examined

Department Cusco

Province Urubamba: Facing the Pacaymayo River, 3900 m alt., very foggy and cold region, near stately ruins of Inca architecture, in moist relic forests, March 1973, *C. Ochoa 4001* (OCH, LE, type collection of *S. incasicum*). Jatun Wuayruro, 3800 m alt., ruin complex of Runcu Raccay, in grasslands, 19-21 February 1980, C. *Ochoa 13631* (CIP, F, GH, MO, MOL, OCH, UNTC, US, USM).

Breeding Potential

This species is self-incompatible. Reciprocal crosses of *S. incasicum* (*OCH 13631*) with *S. bukasovii* (*OCH 13679B* and *13712*) were totally compatible, yielding berries having numerous seeds on the average, and as many as 375 seeds per berry when *S. bukasovii* was used as the staminate parent.

66. *Solanum leptophyes* Bitt., Fedde Repert. Sp. Nov. 12:448-449, 1913.

Figs. 309-313; Map 27; Plate XXX.

S. gourlayi Hawkes, Bull. Imp. Bur. Pl. Breed. and Genet., Cambridge 43, 120, Fig. 27. 1944. Type: ARGENTINA. San Gregorio, 3650 m alt., above Tilcara, 11-15 February 1939, *Balls,Gourlay and Hawkes 5979* (K lectotype designated by J.G. Hawkes, isotype CPC).

S. pachytrichum Hawkes, Bull. Imp. Bur. Pl. Breed. and Genet., Cambridge 45, 121, Fig. 31. 1944. Type: BOLIVIA. Department Chuquisaca, Province Oropeza, near Sucre, 8 March 1939, *Balls, Gourlay and Hawkes 6177* (CPC, K, UC).

S. leptophyes f. *gourlayi* (Hawkes) Correll, Wrightia 2:188. 1961. Type: Based on *Balls, Gourlay and Hawkes 5979.*

S. gourlayi subsp. *pachytrichum* (Hawkes) Hawkes et Hjerting, *The Potatoes of Bolivia*, Clarendon Press, Oxford, p. 284, 288, Fig. 43. 1989.

Plant erect or ascending, somewhat extending or sometimes decumbent, small, 20-30(-50) cm tall, coarsely and sparsely pilose; stem slender, 2-3(-5) mm in dia. at base, simple or branched, flexible or somewhat so, sparsely pilose, narrowly and inconspicuously straight winged, internodes (1.0-)1.5-3.0(-4.0) cm long. Stolons 25-40 cm long; tubers white, whitish or light brown, round to ovoid or pyriform, small, 1.5-2.5 cm long (Fig. 312). Leaves (4.0-)6.0-13.5(-20.0) cm long by (2.0-)3.0-7.5(-13.0) cm wide, imparipinnate, with 3-5(-7) pairs of lateral leaflets and (0-)2-5(-8) pairs of interjected leaflets, more or less pilose with coarse hairs, adpressed and unequally long above, somewhat more pilose or puberulent below. Leaflets ovate-lanceolate or narrowly elliptic-lanceolate to linear-lanceolate, occasionally ovate-elliptic, obtuse or pointed at apex, rarely acuminate. Terminal leaflet slightly larger than the laterals, (1.3-)2.5-3.8 cm long by (0.5-) 1.0-1.5 cm wide; the lateral leaflets gradually descending in size at base, apex obtuse or pointed, base cuneate or rounded to obliquely rounded, shortly petiolulate or sessile, leaflets of the first upper pair (1.0-)2.0-3.5 cm long by (0.3-) 0.6-1.0 cm wide, rarely with the base slightly decurrent about the rachis. Interjected leaflets small, 1-5 mm long, suborbicular, ovate to elliptical, sessile. Pseudostipular leaves semiorbicular or broadly falcate, small, 5-8 mm long. Inflorescence cymose or cymose-paniculate, usually 3-5-flowered, or occasionally with up to 10 flowers; peduncle (2-)5-8 cm long, slender, 1.8 mm in dia., pigmented light brown, as in the case of the pedicels and the calyx, shortly and sparsely pilose as in the case of the pedicels; pedicels (10-)15-25 mm long, articulated near the center or in the upper one-third of their length, or about 7-9 (-11) mm below the calyx. Calyx symmetrical, 6 mm long, pigmented, pilose,

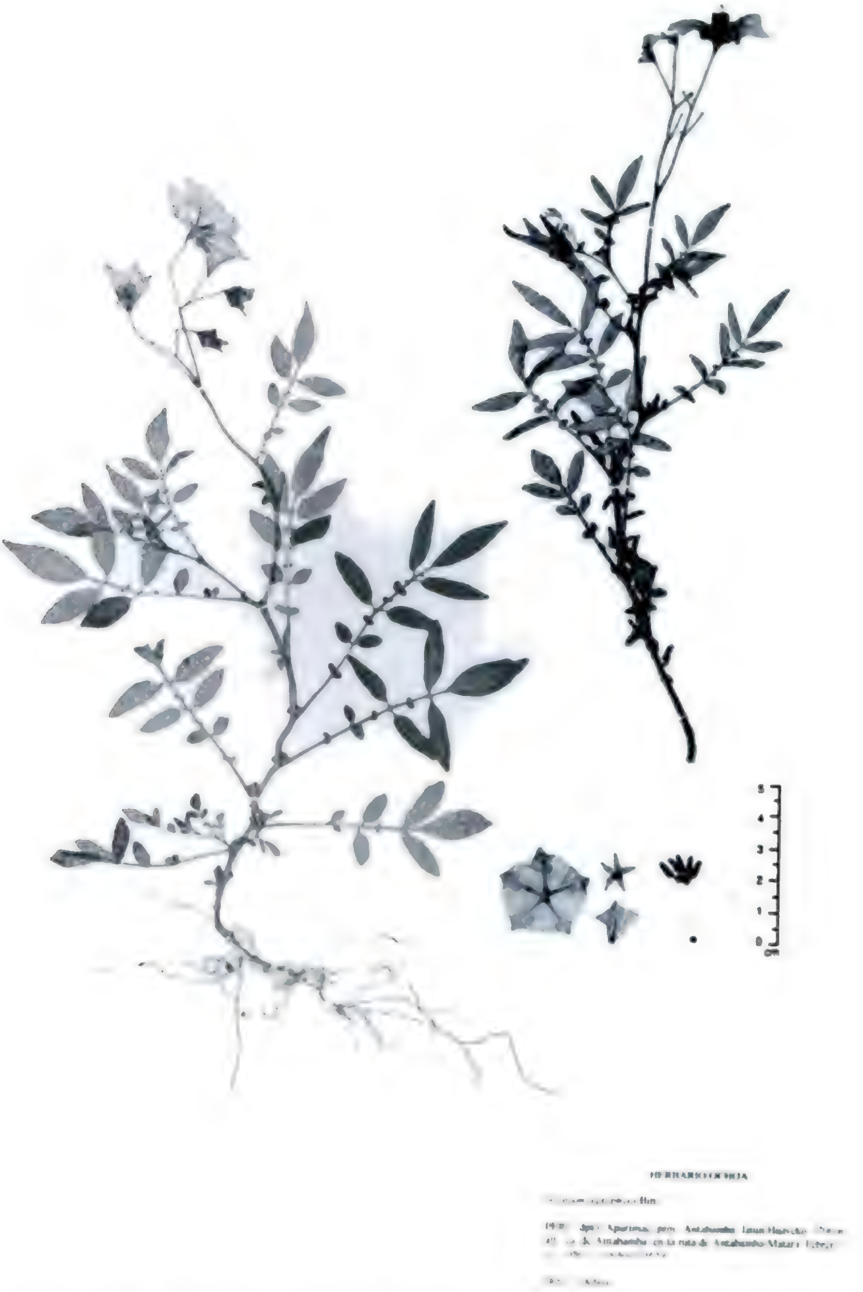


Figure 309. *Solanum leptophyes* Bitt., from Antabamba, Department Apurímac, Peru (*Ochoa 13659*).

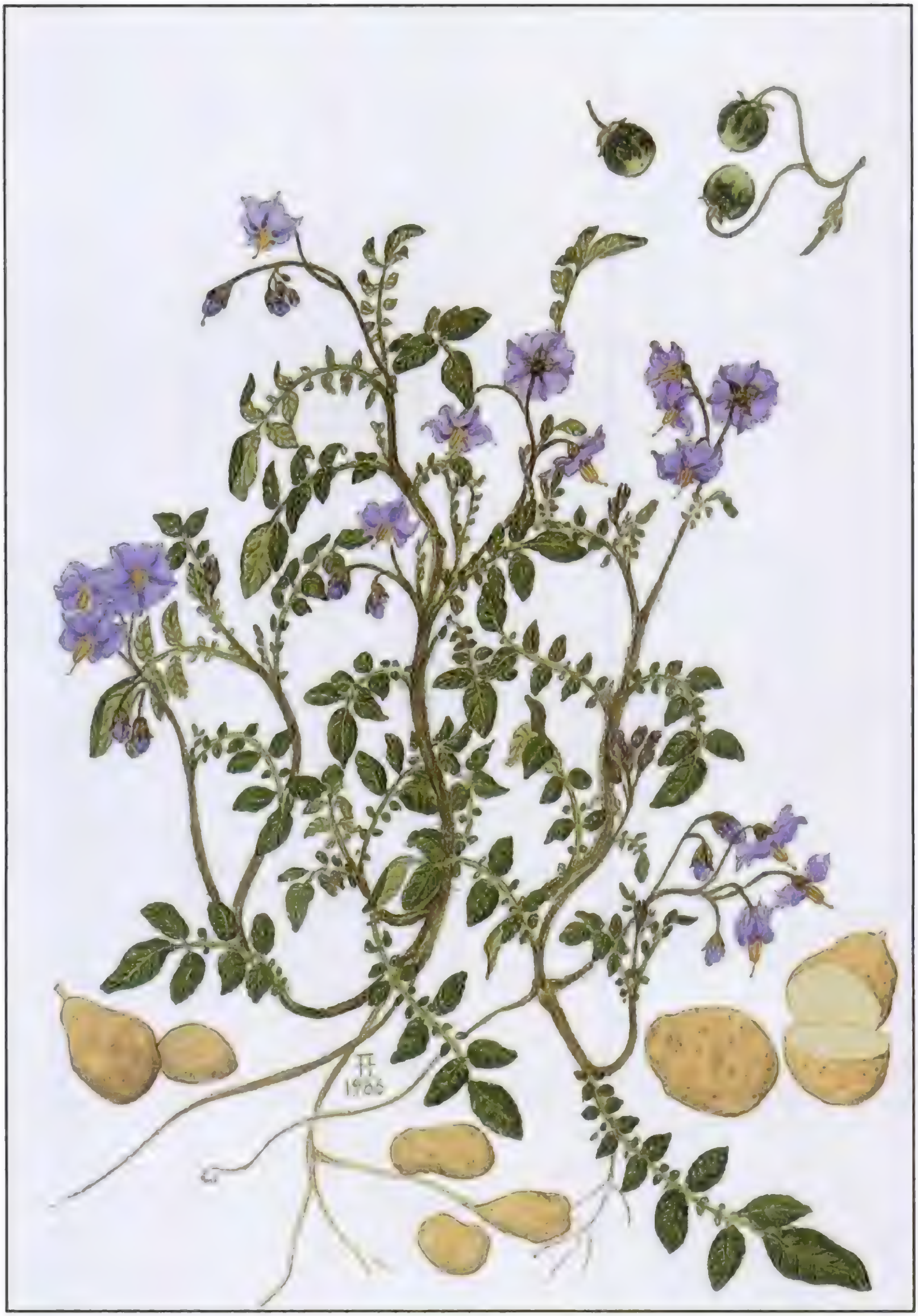


Plate XXX. *Solanum leptophyes* Bitt.

lobes broadly ovate to ovate-subcuadrate, abruptly acuminate, acumens short, about 1-2 mm long. Corolla rotate or rotate-pentagonal, small, 2.0-2.5(-3.0) cm in dia., purple or violet (Fig. 309). Anthers lanceolate, 4.5-5.5 mm long; filaments 0.5-1.5 mm long, glabrous. Style 8-10 mm long, exerted 2.5-3.0 mm, densely papillose along the basal two-thirds of its length; stigma small, capitate to claviform. Fruit globose or slightly ovoid, 1.5 cm in dia., pure green, or green with 1-2 vertical pale purple stripes or occasionally flecked with white dots (Fig. 311). Chromosome Number: 2n=24.

Type: BOLIVIA. Department La Paz [possibly in the Province Murillo], La Paz, 3800 m alt., Andean region, April 1913, O. *Buchtien 3982* (US lectotype, GOET isotype).

Brücher (1985) pointed out the high level of resistance of this species to the cyst nematode *Heterodera rostochiensis*. He also gives a detailed taxonomic treatment of *S. leptophyes* in which he presents a list of seven synonyms that were based on a collection of about 50 specimens that he had examined from the central Andes, the majority of which were from northwest Argentina, but which also included two specimens from Bolivia and one from Peru. This last mentioned specimen corresponds to the writer's field No. *11888*, collected near Chucuito, Puno at 3840 m alt., and not in "Ayacucho, Province Antabamba."

More information on *S. leptophyes* may be found in monographic works by Hawkes and Hjerting (1969) and Ochoa (1990). In the present treatment of *S. leptophyes*, which is based upon the writer's concept of this interesting and controversial species as it has developed from an examination of Bolivian material, new data will be presented, this resulting from the discoveries made during the writer's more recent explorations of Peru.

Affinities

This species is related to *S. bukasovii* and *S. bukasovii* f. *multidissectum*. It differs from these taxa primarily by the more delicate habit of the plant and in having a shorter, and much more slender floral peduncle, a lower point of articulation of the pedicel, smaller flowers with more narrowly rotate-pentagonal corollas and leaflets that are more narrowly lanceolate.

In addition to the above taxa, *S. leptophyes* shares some features in common with the Argentine *S. spegazzini*, particularly ecotypes of that species that have very narrowly lanceolate leaflets. Also, this species resembles the Bolivian *S. vidaurrei* in the slenderness of its stem and in its very narrowly lanceolate leaflets (Ochoa 1990, pp. 292-297). However, *S. vidaurrei* differs from *S. leptophyes* in

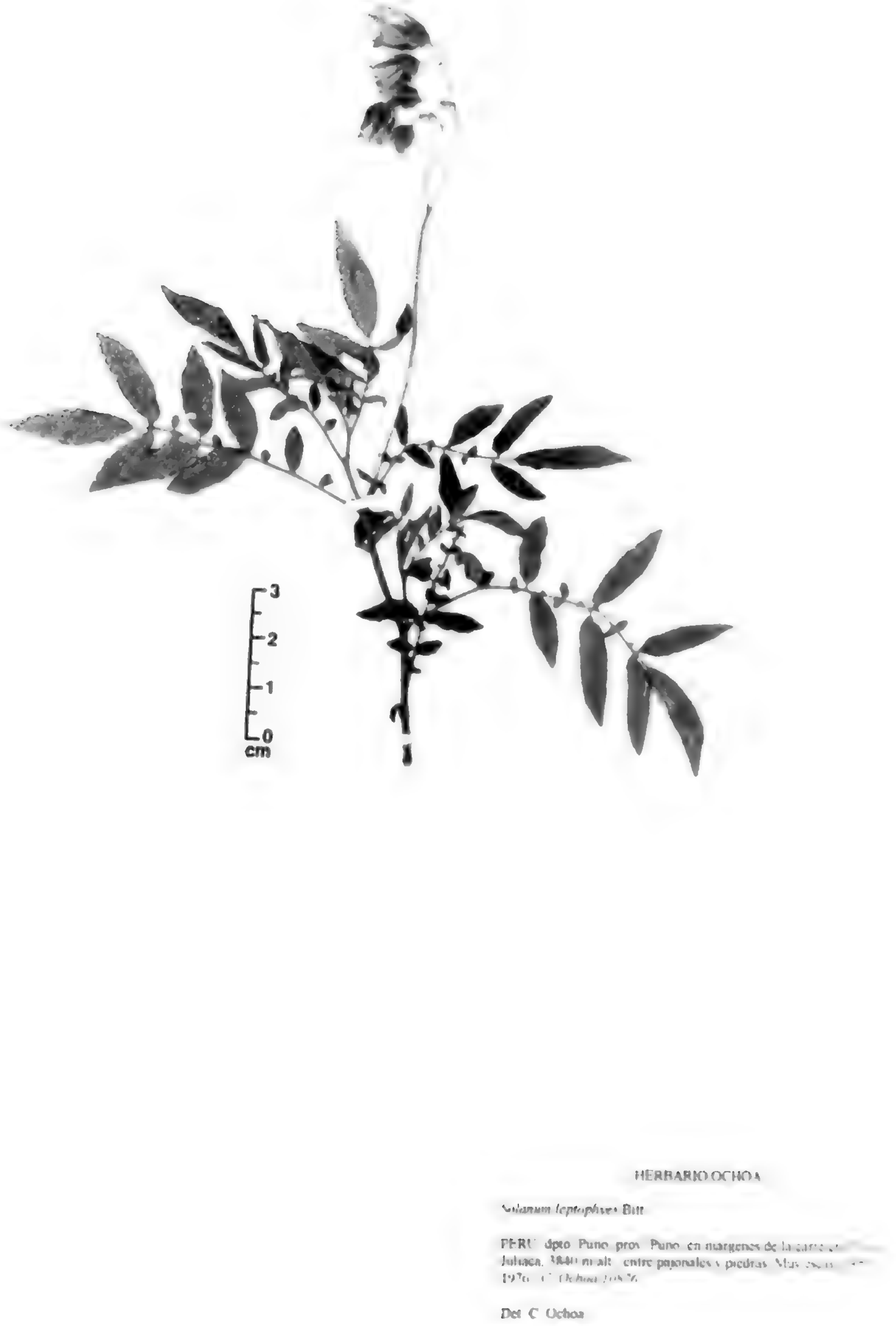


Figure 310. *Solanum leptophyes* Bitt., from Puno, Peru (*Ochoa 10876*).

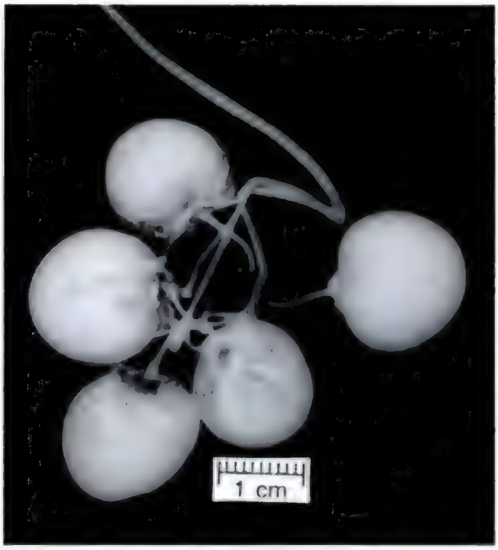


Figure 311. Fruits of *Solanum leptophyes* Bitt. (*Ochoa 13671*).

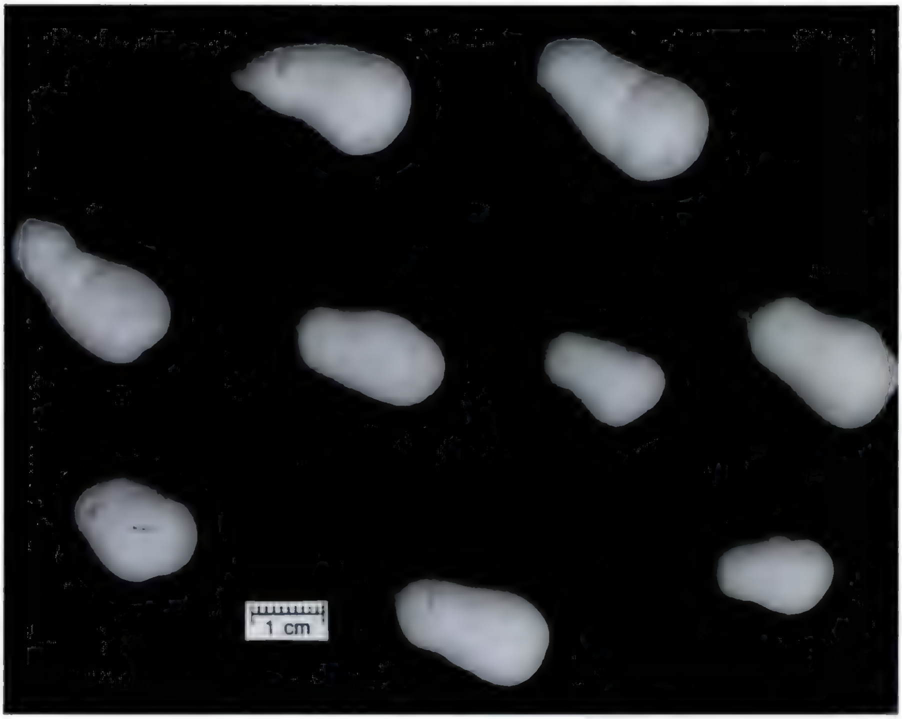


Figure 312. Tubers of *Solanum leptophyes* Bitt.

having longer and finer hairs covering the whole plant, leaflet margins that are finely denticulate and conspicuously pilose, pedicels that are articulated closer to the calyx, symmetrical or asymmetrical calyces with long acuminate lobes and corollas that are subpentagonal and very different from those of *S. leptophyes*. And lastly, while superficially resembling *S. tapojense*, there is little that actually connects these two species, as may be deduced from the original description of *S. tapojense* and its accompanying illustrations (see Ochoa, 1980; in Phytologia 46(4):223).

Habitat and Distribution

Solanum leptophyes occurs in a variety of semiarid to arid habitats in the high Andes, including in *puna* or *prepuna* grasslands of *Stipa ichu* and in rocky fields dominated by *Erdisia*, *Opuntia* and *Agave*. It has also been found occasionally growing in thickets of herbs and shrubs on the steep slopes of narrow quebradas, or on *andenes* or terraces of Inca or pre-Inca construction.

In Peru, this species is distributed in the southern region of the country in the Departments of Cusco, Apurímac and Puno, from approximately 13°19' S and 72°08' W to 16°09' S and 69°05' W (Map 27). Its altitudinal range within this area varies from 2600 to 4000 m.

According to Hawkes and Hjerting (1989), the southern limits of this species are found at approximately 20° S in the Department of Potosí in southern Bolivia; whereas its southernmost limits in Peru are located near the village of Chucuito in the Department of Puno, or very close to the Bolivian border.

Specimens Examined

Department Apurímac

Province Antabamba: Between Matara and Sabaino, 3500 m alt., near bridge above the Antabamba River, along the railroad line to Sabaino, leaves with narrowly lanceolate leaflets and pointed apex, 10 February 1960, C. *Ochoa 2256* (OCH). Vicinity of La Paca, 3450 m alt., near Mollebamba, plants slender, small, 20-25 cm tall, leaves with very narrow leaflets, 25 March 1972, C. *Ochoa 3284* (OCH). Acerromanayoc, 3450 m alt., near Sabayno, 25 March 1972, C. *Ochoa 3285* (OCH). Jatun Huayko, 3700 m alt., near Antabamba, along the Antabamba-Matara road, 21 February 1980, C. *Ochoa 13659* (CIP, OCH). Achocca, 3280 m alt., along the Matara-Huaquirca road, among trees of *Escalonia resinosa* (=chachacomo), *Agave* sp. (= magué), *Erdisia* and some *Stipa*, 21 February 1980, C. *Ochoa 13660*, 2n=24 (OCH). About a few meters from the Mollebamba River, along Mollebamba-Calcausto road, 3300 m alt., plants slender, leaflets narrow, flowers small and violet, 22 February 1980, C. *Ochoa 13665* (OCH). Pampa-Pampa, 3550 m alt., near Antabamba, on ancient Inca terrraces, 21-23 February 1980, C. *Ochoa 13671* (CIP, OCH, MOL, UNTC, from plants grown in the greenhouse at Huancayo) and (OCH, from plants grown in a field at Huancayo).

Province Grau:Vicinity of Pamparackay, 3350 m alt., plants small and slender, leaflets narrowly-lanceolate, corolla violet, small, February 1960, C. *Ochoa*

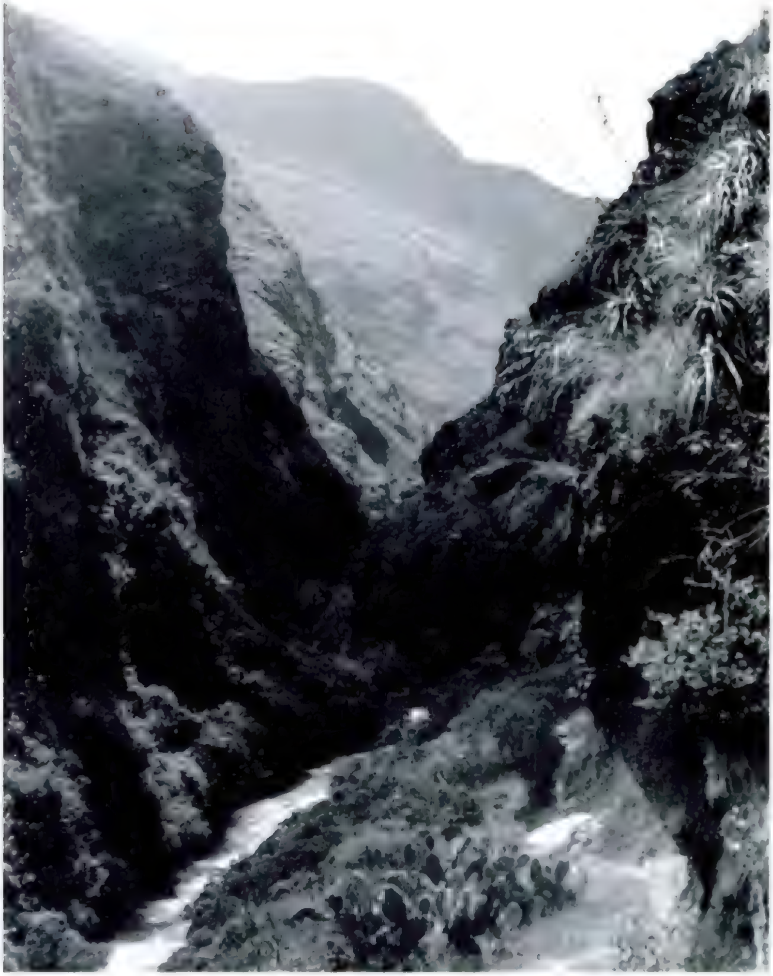


Figure 313. Habitat of *Solanum leptophyes*, a scene along the railroad line between Chuquibambilla and Vilcabamba, Apurímac.

and Pedro López Camarena 2229 (OCH). Chejchirpaniyocc, 3800 m alt., between Pamparackay (San Antonio) and Mamara, in grasslands of *Stipa*, growing with a colony of *Opuntia exaltata* on rocks, berries long-ovoid, 6 March 1980, *C. Ochoa 13729*, 2n=24 (CIP, OCH). Molino Huayck'o, 3600 m alt., between Mamara and Totora, in thickets of a narrow quebrada, corolla violet, 6-20 March, 1980, *C. Ochoa 13730*, 2n=24 (CIP, OCH, USM). Molino Huayck'o, 3600 m alt., along the Mamara-Totora railroad line, 6 March 1980, *C. Ochoa 13730A* (OCH, from plants grown in the greenhouse at Huancayo). Molino Huayck'o, 3600 m alt., along the horse trail from Mamara to Totora, District Mamara, in a narrow quebrada dominated by herbaceous and shrubby vegetation, plants slender, flowers small and blue, 6 March 1980, *C. Ochoa 13731* (OCH). Huanchojlla, 3340 m alt., between Mamara and Totora, 6 March, 1980, *C. Ochoa 13733*, 2n=24 (CIP, OCH). In rocky foothills of Cerro Isla, 3560 m alt., District San Antonio, associated with *Sonchus* sp. and small shrubs of *Cassia,* between tufts of *Stipa ichu*, very rare, this island is an isolated and unique mountain peak in the pampa between Mamara and San Antonio, 8 March 1980, *C. Ochoa 13739*, 2n=24 (CIP, OCH). Ranra, 3450 m alt., along the horse trail from San Antonio to Ayrihuanca, among large rocks and trees of *Eucaliptus* and *Cassia*, flowers violet-lilac, 9 March 1980, *C. Ochoa 13743*, 2n=24 (CIP, MOL, OCH).

Department Cusco

Province Quispicanchis: Ruins of Piquillacta, 3200 m alt., near Oropeza, among old stone walls, plants and flowers small, March 1974, *O. Blanco s.n.* (OCH). Near Jaucat, 3500 m alt., between Chuquicahuana and Puente Cusipata, 16 February 1980, *C. Ochoa 13621*, 2n=24 (CIP, OCH).

Province Urubamba: Slopes of Yahuarmaqui, 2860 m alt., in clay soil among cacti, corolla sky blue, 28 February 1949, *C. Vargas C. 7867* (CUZ, LL, OCH). Between km 24-25 of the route Cusco-Urubamba, 2900 m alt., near Urubamba, 15 February 1960, *C. Ochoa 2179* (OCH). Above Urubamba, 3200 m alt., km 25 on the Urubamba-Izcuchaca road, dry, sandy, steep cliff almost devoid of any other vegetation. March 9, 1963; *D. and V. Ugent 4195, 4196* (OCH), *4197* (WIS) and *4203* (WIS).

Department Puno

Province Puno: Near Puno, 4000 m alt. February 1936, *J. Soukup 262* (F). Along the borders of the Puno-Juliaca road, 3840 m alt., in grasslands and among rocks, very rare, April 1976, *C. Ochoa 10876*, 2n=24 (OCH) and (CIP, OCH, from plants grown in the greenhouse at La Molina, Lima). Near Chucuito, 3840 m alt., 25 February 1978, *C. Ochoa 11888* (OCH, US).

Putative Natural Hybrids of *Solanum leptophyes*

Solanum leptophyes × *S. bukasovii*

The plants of this collection resemble *S. leptophyes* in their slender, graceful habit (but are lacking rosette leaves at base of stem) and small rotate flowers. They are like *S. bukasovii* in having elliptic or broadly elliptic leaflets, very short petiolules, more vigorous peduncles and pedicels that are articulated closer to the calyx.

Specimens Examined

Department Apurímac

Province Antabamba: Apacheta, 4280 m alt., between Mollebamba and Antabamba, 21-23 February 1980, *C. Ochoa 13667*, 2n=24 (OCH) and (CIP, OCH, from plants grown in the greenhouse at Huancayo).

Province Grau: Pajcha Ck'uchu, 3550 m alt., between Totora and Turpay, in rocky soil, with trees of *Aliso* (=*Alnus*), Capuli (=*Prunus*) and Chachacomo (=*Escallonia*), flowers violet, leaflets narrow, 7 March 1980, *C. Ochoa 13734*, 2n=24 (CIP, OCH).

Solanum leptophyes × *S. bukasovii* f. *multidissectum*

Plants of this cross resemble *S. bukasovii* f. *multidissectum* in having more robust stems, rotate-pentagonal corollas and more greatly divided leaves, these having up to 6-7 leaflets and 10-12 interjected leaflets. However, the leaflets of these plants more closely resemble those of *S. leptophyes* with respect to their smaller size, more narrowly-lanceolate shape and pointed tips. Chromosome Number: 2n=24.

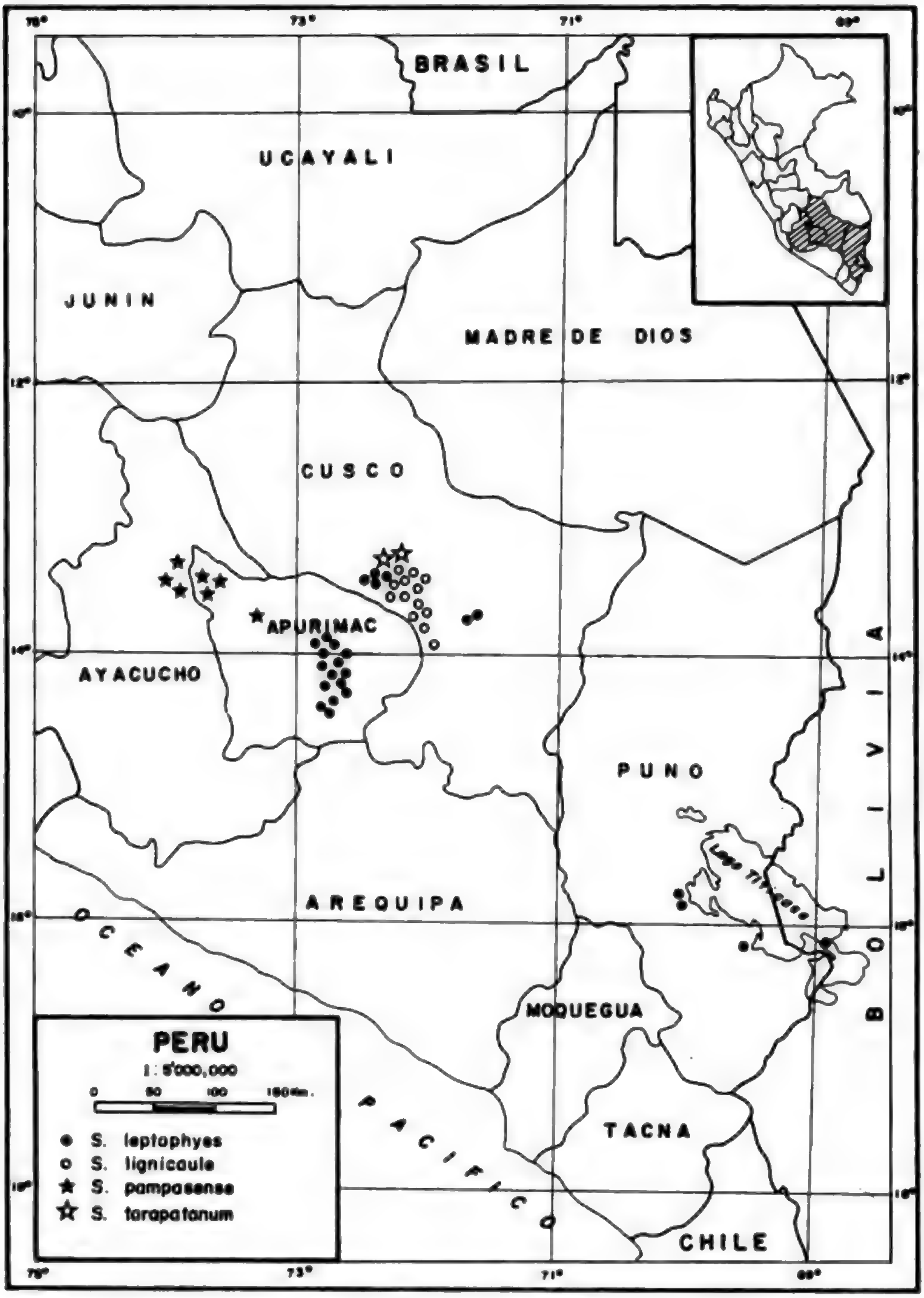
Specimens Examined

Department Puno

Province Puno: Quebrada de Cuturati, 3820 m alt., along the Puno-Chucuito road, growing near *S. acaule* and *S. leptophyes*, among large rocks and tufts of *Stipa ichu*, 27 January 1980, *C. Ochoa 13546 p.p.* (CIP, OCH).

Breeding Potential

The results of crosses of *S. leptophyes* (2n=24 and EBN=2) with diploid species of EBN=1 or EBN=2 and with triploids (2n=36) are given in Table 80, while the materials used in these experiments are shown in Table 81.



Map 27. Distribution of *S. leptophyes*, *S. lignicaule*, *S. pampasense* and *S. tarapatanum*.

Unilateral crosses between *S. leptophyes* and *S. humectophilum* were totally unsuccessful, a fact which is not surprising in view of the different EBN values of these two species and the fact that they belong to totally different taxonomic series. However, the reciprocal crosses that were made between *S. leptophyes* and *S. huancabambense* were also totally incompatible, and this despite the fact that these two plants are of the same ploidy level, have the same EBN values and are of the same taxonomic series. On the other hand, large number of seeds were obtained in the reciprocal crosses of *S. leptophyes* with *S. limbaniense* and *S. rhombilanceolatum* of Series Conicibaccata, even though the latter series may be regarded as fairly distant from Tuberosa.

The close relationship that exists between *S. leptophyes* and *S. bukasovii* is reflected in the results of the reciprocal crosses that were made between these two species. In this case, fairly large numbers of seeds per berry were obtained on the average. Similarly, excellent seed set was experienced in reciprocal crosses of *S. leptophyes* with another related species, *S. ambosinum*. Reciprocal crosses involving the two cultivated species, *S. goniocalyx* and *S. phureja*, were also highly successful, but always more so in one direction than in the other. However, much fewer seeds per berry were obtained in crosses involving *S. leptophyes* and species that are much further apart taxonomically, such as *S. tapojense*, *S. brevicaule*, *S. sparsipilum*, *S. boliviense* and *S. marinasense*. And lastly, very low seed set was obtained in crosses involving *S. leptophyes* and triploid clones of *S. medians*, and only when *S. medians* was used as the pistillate parent.

Table 80. Fertility of *Solanum leptophyes* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	PIURANA	× *S. humectophilum*	10	0	0
24	2	CONICIBACCATA	× *S. limbaniense*	5(7)	4(5)	231(51)
			× *S. rhombilanceolatum*	5(9)	5(9)	200(111)
24	2	MEGISTACROLOBA	× *S. boliviense*	3	3	45
			× *S. raphanifolium*	14(9)	3(7)	141(16)
24	2	TUBEROSA	× *S. ambosinum*	4(9)	4(9)	100(226)
			× *S. brevicaule*	6(5)	6(5)	28(62)
			× *S. bukasovii*	106(60)	76(54)	171(186)
			× *S. goniocalyx*	17(5)	16(4)	14(104)
			× *S. huancabambense*	6(13)	0(6)	0(0)

			× *S. marinasense*	47	32	51
			× *S. phureja*	17(11)	14(7)	256(53)
			× *S. sparsipilum*	37(6)	17(5)	28(60)
			× *S. tapojense*	3(7)	2(5)	28(67)
36	2	TUBEROSA	× *S. medians*-3x	6(12)	0(5)	0(12)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 81. Collections (OCH) used in *Solanum leptophyes* fertility studies.

CONICIBACCATA
S. limbaniense 14291
S. rhombilanceolatum 11869, 13112

MEGISTACROLOBA
S. boliviense 11935
S. raphanifolium 13625, 14296

PIURANA
S. humectophilum 11753

TUBEROSA
S. ambosinum 13849
S. brevicaule 11934
S. bukasovii 7726, 11292, 11844, 13121, 13166,13173, 13174, 13622, 13676, 13679A, 13692,13715, 13749A, 13813, 13859, 14332, 14355,14743
S. goniocalyx 00001
S. huancabambense 14815
S. leptophyes 13621, 13671, 13729, 13730, 13730A, 13731, 13733, 13743
S. marinasense 13673, 13736, 13740
S. medians-3x 14908
S. phureja 15071, 15072, 15132, 15133
S. sparsipilum 11822, 12035, 13644, 13774
S. tapojense 11821

67. *Solanum longiusculus* Ochoa, Phytologia 63(5):329-330, illustr., 1987. Figs. 314-315; Map 28.

Plant erect to erect-ascending, 70-80 cm tall; stem slender, 5-7 mm in dia. at base, pigmented or slightly pigmented along the basal two-thirds of its length, glabrescent, hairs very short and sparse, barely distinguishable, wings scarcely visible; internodes conspicuously long, 6-8-10 cm long. Stolons to 150 cm or more long; tubers round, small, 1.0-1.5 cm in dia., white. Leaves long and narrow, (11.5-)16.0-20.0 cm long by (5.5-)7.5-10.0 cm wide, imparipinnate, with 4-5 pairs of leaflets and 5-7(-10) pairs of small, sessile interjected leaflets; petioles narrowly decurrent about the stem; rachis, petioles and axils shortly pilose, hairs simple, alternating with a few very short tetraglobular glandular hairs. Leaflets

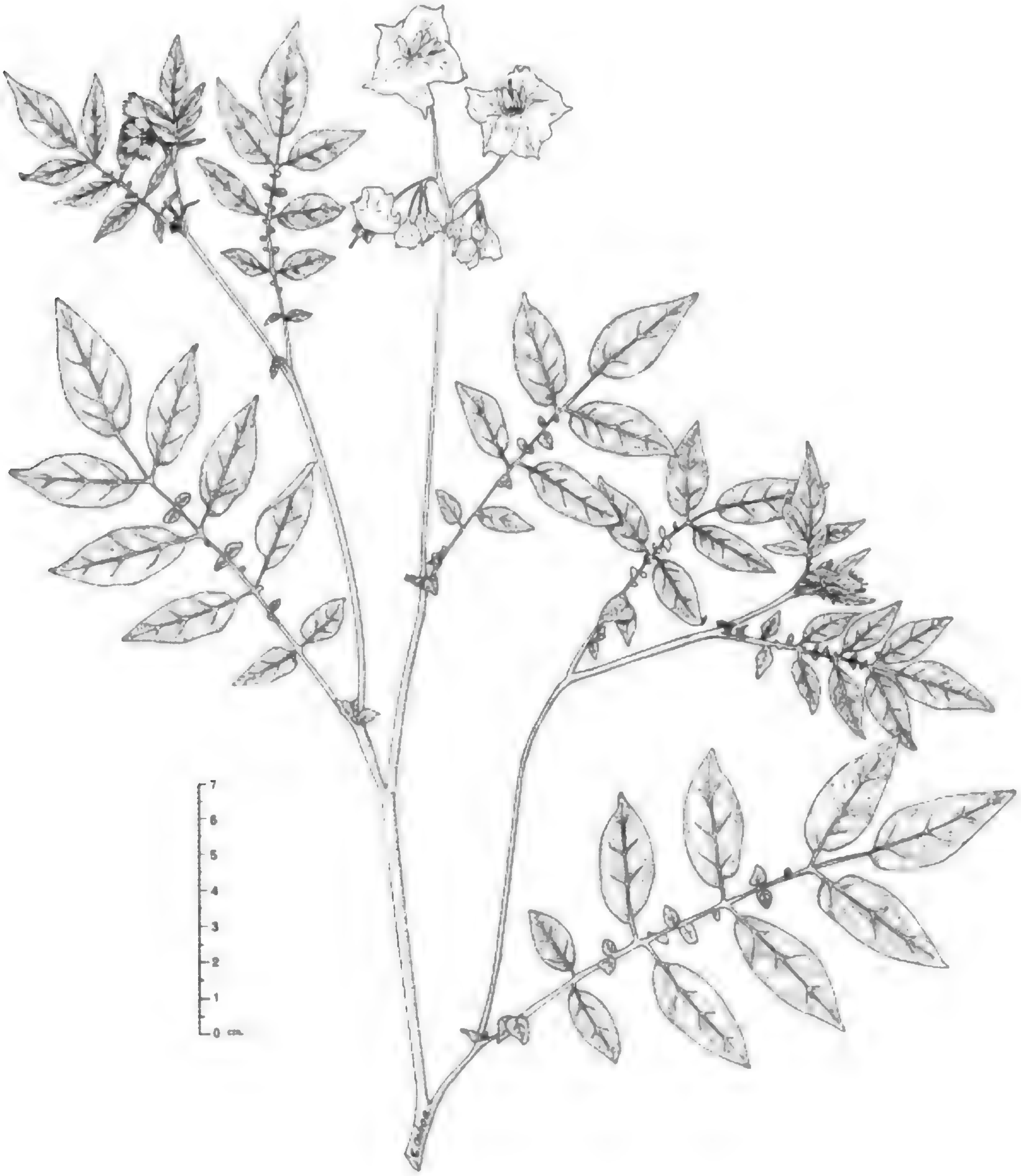


Figure 314. *Solanum longiusculus* (*Ochoa 4125*, holotype).

elliptic-lanceolate or narrowly elliptic-lanceolate, with a pointed apex and obliquely rounded base, on petiolules 3-7 mm long, leaflets more or less densely pubescent with very short adpressed hairs above, including the petiolules, more densely pubescent or puberulent principally on the veins and veinlets below. Terminal leaflet 2.8-5.0 cm long by 1.2-1.8 cm wide, the first pair of lateral leaflets somewhat smaller than the terminal leaflet, 2.3-4.0 cm long by 0.8-1.2 cm wide, the remaining pairs of lateral leaflets gradually diminishing in size toward the base; interjected leaflets elliptic to ovate, sessile, small, 1-6 mm long. Pseudostipular leaves broadly subfalcate, 8-12 mm long by 4-6 mm wide. Inflorescence cymose, 7-10(-14)-flowered; peduncle 10 cm long by 1.8 mm in dia. at base, puberulent as in the case of the pedicels and the calyx; pedicels 20-25 mm long, usually articulated 4-5 mm below the base of the calyx or in the upper one-third of their length. Calyx symmetrical or asymmetrical, 6.5-8.0 mm long; lobes narrowly elliptic-lanceolate to subcuadrate at apex, shortly acuminate, acumens 1.5-2.0 mm long, pointed. Corolla rotate-pentagonal, 2.5-3.0 cm in dia. (Fig. 315), blue-violet. Anther column cylindric-conical, anthers narrowly lanceolate, 5.5 mm long, base cordate; filaments white-hyalinous, 0.5-1.0 mm long, glabrous. Style 10 mm long, glabrous; stigma small, oval-compressed. Fruit ovoid, 15 mm long, pure green or occasionally green with one or two vertical violet stripes. Chromosome Number: 2n=24.

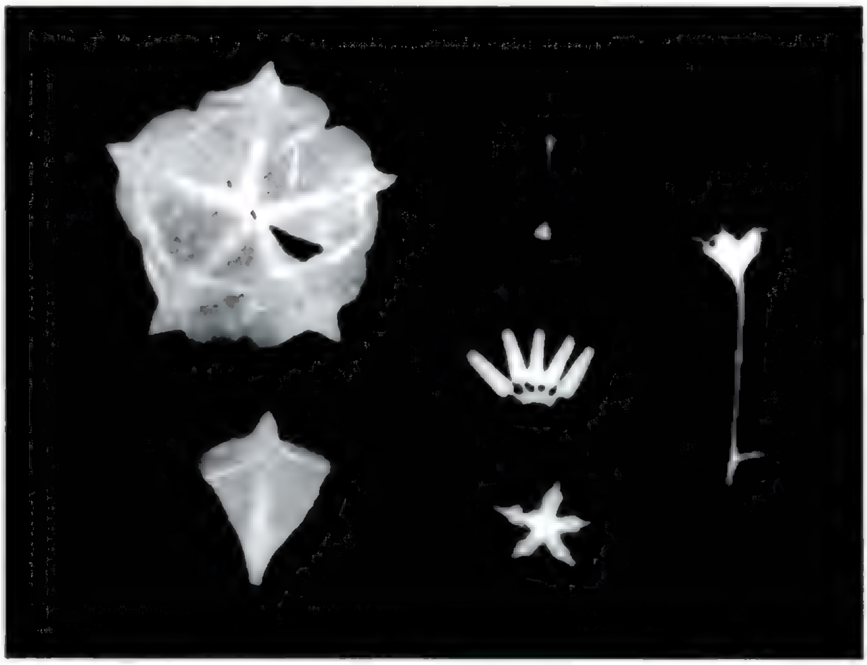
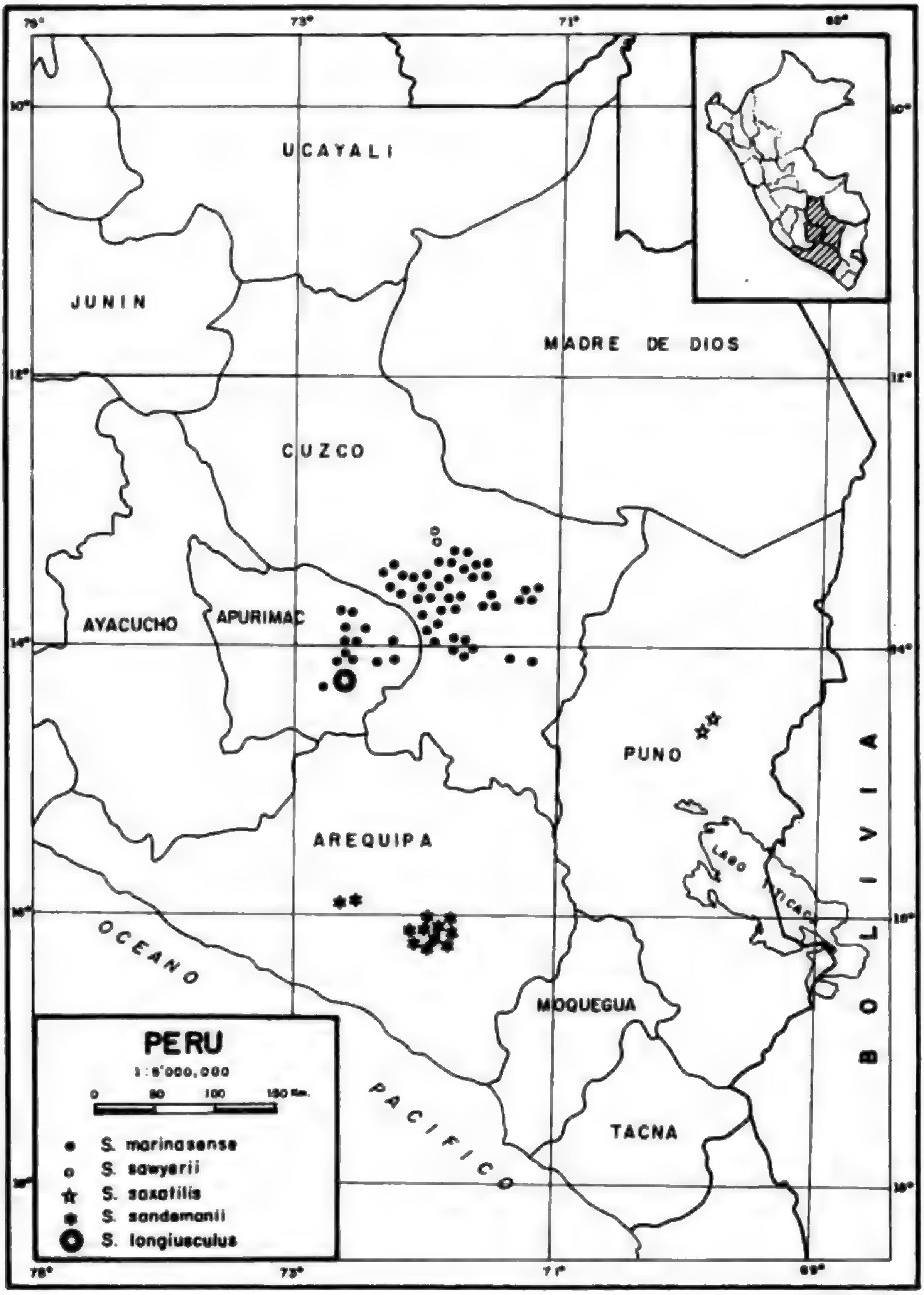


Figure 315. Floral dissection of *Solanum longiusculus* (*Ochoa 4125*, holotype).



Map 28. Distribution of *S. marinasense*, *S. sawyeri*, *S. saxatilis*, *S. sandemanii* and *S. longiusculus*.

Type: PERU. Department Apurímac, Province Grau, Ranra, 3400 m alt., between Ayrihuanca and Pamparackay, March 1973, C. *Ochoa 4125* (holotype OCH, isotype US).

Affinities

Considering the long stem internodes and peduncles of *S. longiusculus*, as well as its very narrow leaves, it would seem possible that this plant originated as a natural hybrid between *S. bukasovii* and *S. leptophyes*. In any event, this species would appear to be more closely related to *S. bukasovii* and *S. leptophyes* than to any others.

Habitat and Distribution

This species is known only from the high, cool *puna* or *prepuna* region of Peru, where it grows at elevations between 3400 and 3500 m altitude. It is typically found in organically rich soils among rocks and bushes of the genus *Cassia* or with such herbaceous plants as *Cajophora* and *Stipa ichu*.

At present, this species is known only from its type locality in the Province of Grau, Department Apurímac, in southern Peru (Map 28).

Specimens Examined

Department Apurímac

Province Grau: Near Chuquibambilla, 3000 m alt., along the Lambrama-Chuquibambilla road, 24 February 1960, C. *Ochoa 2222* (OCH). Puysho, 2950 m alt., between Chuquibambilla and Vilcabamba, heading down the railroad line to Vilcabamba, April 1972, C. *Ochoa 3653* (MOL, OCH, USM, from plants grown at Universidad Nacional Agraria, La Molina, Lima, from original seed collected at Puysho). Ranra, 3400 m alt., between Ayrihuanca and Pamparackay, 3400 m alt., March 1973, C. *Ochoa 4125* (OCH, US, type collection of *S. longiusculus*).

68. ***Solanum lopez-camarenae*** Ochoa, An. Cientif. Univ. Nac. Agraria, Lima, 12(1-2):12-16, illustr., 1974.

Figs. 316-318; Map 26.

Plant robust, erect to erect-ascending, up to 2 m or more tall, essentially entirely glabrous or subglabrous; stem with axillary branches developing from the basal one-third of the plant, woody or subwoody, cylindrical, smooth, wingless, up to 2 cm in dia. at base, marked with violet pigment or pigmented deep violet along the basal two-thirds of its length and in the leaf axils; internodes (3.5-)5.0-10.0 (-12.0) cm long. Stolons up to 1 m or more long; tubers whitish-yellow or white-hyalinous, irregularly submoniliform or long subcylindrical, falcate to slightly fusiform, some tuber-bearing, up to 15 cm long and 3-4 cm thick (Fig. 316), lenticulate. Leaves (15.0-)18.5-27.0(-31.0) cm long by (8.5-)10.0-15.0(-23.0) cm wide, of an unusual color, greenish-blue or greenish-ashen and somewhat shiny above and green-violet or violet below, imparipinnate with 4-5(-6) pairs of leaflets and 0-3(-5) pairs of interjected leaflets; rachis narrowly winged. Leaflets narrowly lanceolate, with long-acuminate apices and narrowly attenuate or slightly oblique bases, cuneate, subsessile or shortly petiolulate; terminal leaflet slightly larger than the laterals of the first adjacent pair, (5.5-)6.5-10.5(-12.5) cm long by (1.2-)2.0-2.7(-3.0) cm wide; leaflets of the first upper pair (4.5-)5.5-9.0(-11.5) cm long by (1.0-)1.5-2.0(-2.5) cm wide, the lateral leaflets of the second upper pair or the central pairs frequently somewhat larger than the those of the first pair, the lowermost pair considerably smaller. Interjected leaflets ovate to ovate-lanceolate, sessile, small, 1-8 mm long. Pseudostipular leaves broadly falcate, slightly clasping, 7-20 mm long by 5-13 mm wide. Inflorescence usually cymose, very floriferous, 20-40-flowered; peduncle (2-)4-7 cm long by 1.5-2.0 mm in dia. at base, bi- or trifurcate, slightly pigmented, glabrous as in the case of the pedicels and the calyx; pedicels 15-25(-30) mm long, pigmented, articulated 3(-4) mm below the base of the calyx. Calyx asymmetrical, strongly pigmented, very small, 3-4 mm long, lobes broadly ovate with scarious margins and apiculated apices. Corolla rotate, somewhat infundibuliform, 2.5-2.8(-3.8) cm in dia. (Figs. 316, 318), purple to purple-lilac with a dark violet-lilac internal star, nearly black, acumens prominent, cuculate. Anther column subcylindric or cylindrical-conical, anthers narrowly lanceolate, (6-)7-8 mm long, pale yellow, sparsely puberulent on the dorsal side, hairs distinguishable only with a hand lens, with a well defined dorsal groove, base cordate; filaments short, 0.5 mm long, pigmented deep purple, very shortly pubescent. Style 11-12 mm long, exerted 3 mm, very slender or filiform, not papillose but densely clothed with short, setose hairs along the lower three-quarters of its length; stigma claviform, strongly cleft, nearly

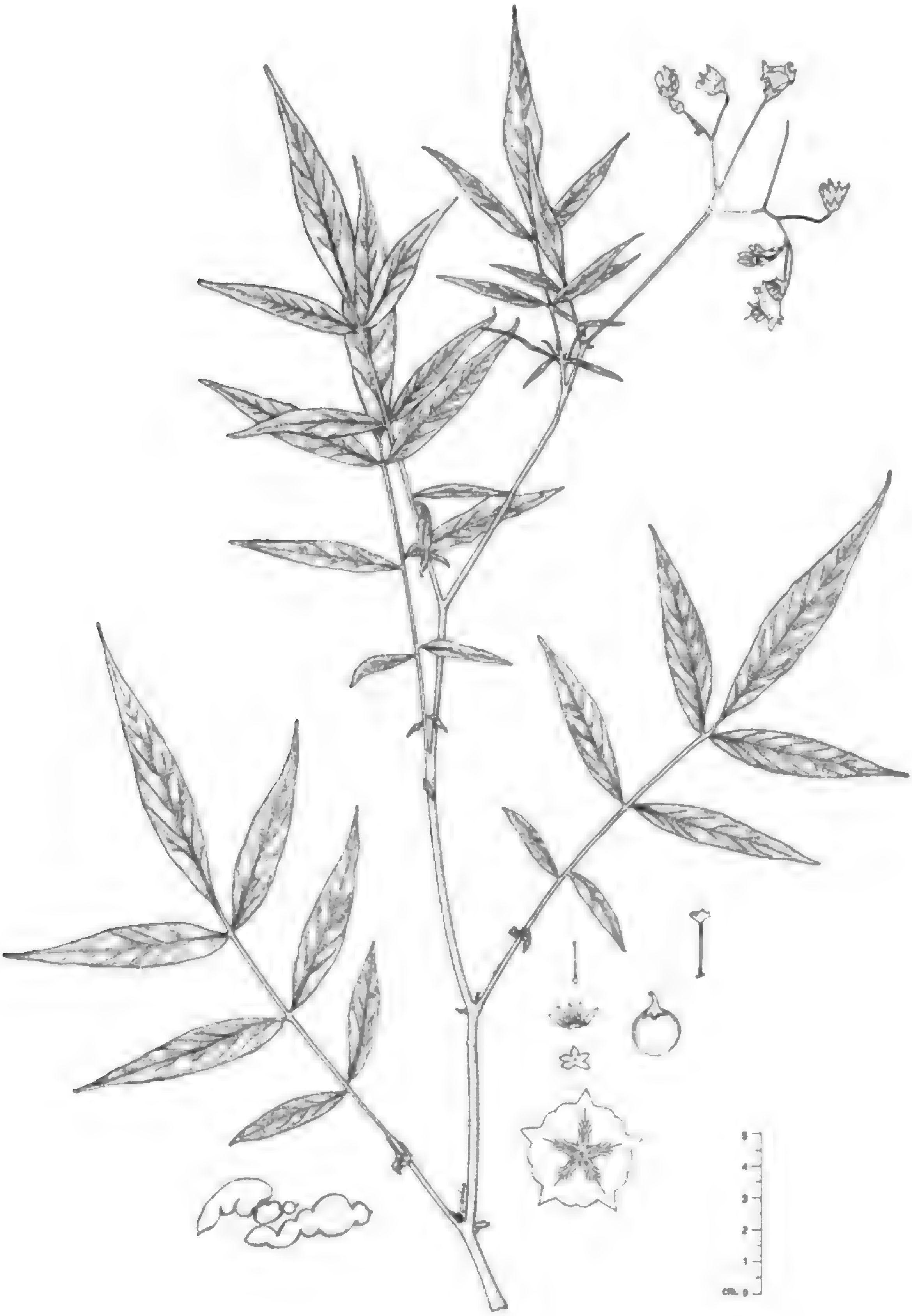


Figure 316. *Solanum lopez-camarenae* (*Ochoa 11672*, topotype).

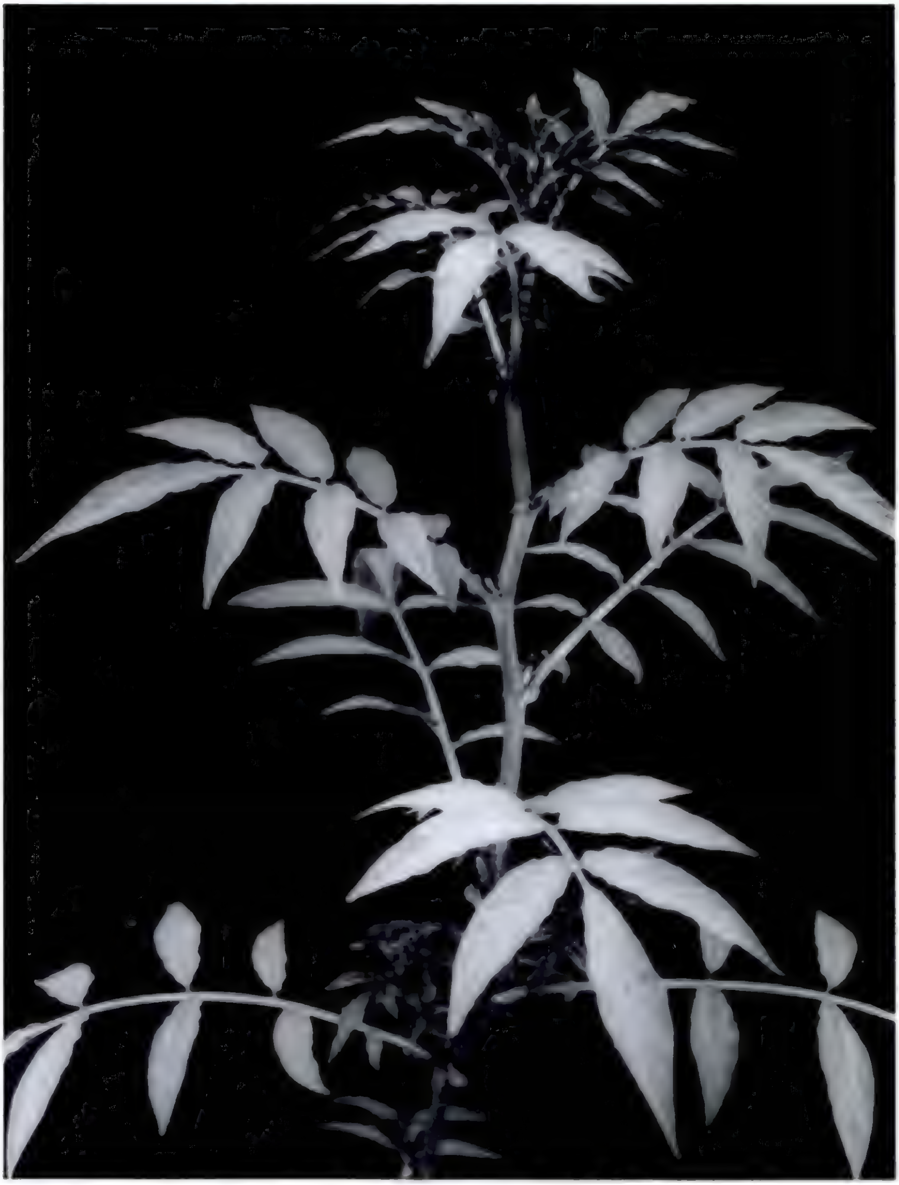


Figure 317. *Solanum lopez-camarenae* (*Ochoa 3251*), in its habitat, Montañas de Suro Chico, Cajamarca.

bífid, slightly enlarged at apex of the style. Fruit round, 1.5-1.8 cm in dia., green at maturity (with 80 seeds per berry on the average). Chromosome Number: 2n=24. EBN=1.

Local Name: *Papa de Zorro* (=Fox Potato).

Type: PERU. Department Cajamarca, Province Cutervo, Montaña del Suro Chico, 2700 m alt., among mountain shrubs, 4 March 1973, C. *Ochoa 3606* (holotype OCH, isotypes MO, MOL, OCH, US).

This species is highly resistant to potato late blight, or *Phytophthora infestans*.

Affinities

Solanum lopez-camarenae is a very exotic Peruvian tuber-bearing species. It is characterized principally by its unusual dark greenish-blue upper foliage coloration, the almost complete absence of an indumentum, the long, narrow and conspicuously acuminate lanceolate leaflets, the unusual, but scarcely distinguishable puberulence of the dorsal part of the anthers and the finely setose style. This combination of characters are not found in any other species.

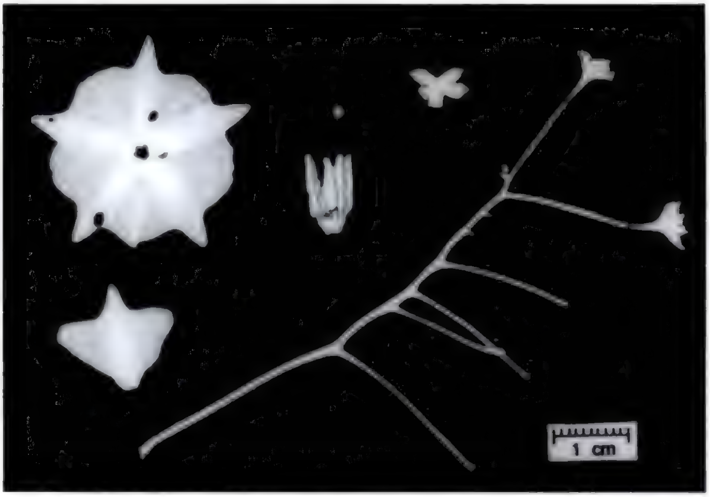


Figure 318. Floral dissection of *Solanum lopez-camarenae* (*Ochoa and Salas 15228*).

Habitat and Distribution

This species grows in moist soil among mountain trees and shrubs and in thickets of herbaceous plants. It has also been collected from forest borders and clearings, where it may grow in close association with *Juglans*, *Weinmania*, *Cecropia*, *Chusquea*, *Calceolaria* and various species of melastomes, ferns and begonias.

Solanum lopez-camarenae is presently known only from the Province of Cutervo, Department Cajamarca, in northern Peru, where it occurs at altitudes between 2500 and 3000 m (Map 26).

Specimens Examined

Department Cajamarca

Province Cutervo: Montaña del Suro Chico, 2700 m alt., in very moist forest, plants very young, 27 February 1972, *C. Ochoa 3251* (OCH). Montaña del Suro Chico, 2700 m alt., near Perlamayo and Santo Domingo, among mountain shrubs and trees, very moist, plants up to 2 m tall, flowers violet-lilac, n.v. *Papa de Zorro*, 4 March 1973, *C. Ochoa 3606*, 2n=24 (MO, MOL, OCH, US, type collection of *S. lopez-camarenae*). District Socota, Cerro de Las Palmas, 2800 m alt., near Pampa de La Rioja, 5 June 1977, *C. Ochoa 11672*, 2n=24 (CIP, OCH). District La Lucma, Montaña del Santo Domingo, 3000 m alt., at the margins of very moist forests or in thickets of shrubs and herbs, scarce, resistant to *Phytophthora infestans,* plants vigorous, tall, leaves dark grayish-green, glabrous, June 1977, *C. Ochoa 11751*, 2n=24 (CIP fragment, GH, MO, MOL, OCH). Lower levels of Pampa de La Rioja, 2550 m alt., plants robust to more than 2 m alt., among forest shrubs, tubers moniliform or subfalcate, 3-5 cm long, n.v. *Papa de Zorro*, 29 May 1983, *C. Ochoa and A. Salas 15228* (CIP, GH, MO, MOL, OCH, US). Pampa de La Rioja, 2500 m alt., plants up to 2.5 m tall, robust, stems cylindrical without wings, flowers pale violet with deep violet, nearly black internal star, 29 April 1992, *C. Ochoa and A. Salas 16078* (CIP, OCH, MOL).

69. *Solanum marinasense* Vargas, *Las Papas Sudperuanas*, Publ. Univ. Nac. Cusco, Part 1, 83, illustr., 1949, *nom. nud.*; Part 2, 53, 1956.

Figs. 319-326; Map 28; Plate XXXI.

S. marinasense var. *dentifolium* Vargas, *Las Papas Sudperuanas*, Publ. Univ. Nac. Cusco, part 2, 56, 1956. Type: PERU. Department Cusco, Province Paucartambo, between Illichiua and Añobamba, 3100-3500 m alt., 18/20 January 1946, *C. Vargas C. 5566* (CUZ, LL, OCH).

S. lechnoviczii Hawkes var. *xerophyllum* Vargas, *Las Papas Sudperuanas*, Publ. Univ. Nac. Cusco, part 2, 61, illustr., 1956 (as var. *xerophylla*). Type: PERU. Department Cusco, Province Calca, Tunasmocco, 24 February 1944, *C. Vargas C. 4088* (CUZ, LL).

S. longimucronatum Vargas, *Las Papas Sudperuanas*, Publ. Univ. Nac. Cusco, part 2, 60-61, illustr., 1956. Type: PERU. Department Apurímac, Province Abancay, Curahuasi, Quebrada de Suiluluchayok, 25 February 1950, *C. Vargas C. 9218* (CUZ, LL).

S. cuzcoense Ochoa, Agronomía, Lima 26:219, illustr., 1959. Type: PERU. Department and Province Cusco, Granja K'ayra, Quebrada de las Andenerías, 3300 m alt., March 1957, *C. Ochoa 2142* (OCH).

S. canasense var. *xerophyllum* (Vargas) Corr., Wrightia 2:185, 1961. Type: Same as *Vargas 4088* (CUZ, LL).

S. marinasense f. *longimucronatum* (Vargas) Corr., Wrightia 2:181, 1961.

S. pampasense f. *glabrescens* Corr., Wrightia 2:183, 1961. Type: PERU. Department Apurímac, Province Abancay, Casinchihua, 2200 m alt., 10 February 1939, *H.E. Stork, O.B. Horton and C. Vargas C. 10577* (F, G, NA).

Plant erect, (25-)50-70(-100) cm tall, subglabrous; stem simple or little-branched, (2-)5-8 mm in dia. at base, slightly pigmented, light green, sparsely and shortly pilose, inconspicuously and narrowly straight winged; internodes (2-)3-5(-7) cm long. Stolons to 50 cm or more long; tubers round to ovoid, whitish-yellow, 1.5-2.5 cm long. Leaves (9.0-)15.0-25.0(-32.5) cm long by (7.5-)9.0-17.5(-23.5) cm wide, the rachis sparsely pilose, imparipinnate, with (2-)3-4 pairs of lateral leaflets and (0-)2-4(-5) pairs of interjected leaflets, yellowish-green and somewhat shiny, glabrous or glabrescent to pilose above and green-whitish and densely puberulent or tomentose below. Leaflets lanceolate or elliptic-lanceolate, with entire or subdenticulate margins, apex short or long-acuminate and the base obliquely cuneate or rounded, shortly petiolulate, petiolules 1.5-3.0 mm long (occasionally 10 mm or more long). Terminal leaflet somewhat larger than the laterals, (4.6-)5.0-7.5(-10.6) cm long by (1.8-)2.8-4.3(-5.0) cm wide; the first pair of lateral leaflets (2.5-)4.0-6.5(-9.0) cm long by (1.0-)1.7-2.7(-4.0) cm wide, rarely narrowly decurrent about the rachis. Interjected leaflets, when present, suborbicular to ovate, small, 2-7 mm long, sessile. Pseudostipular leaves conspicuously lunate-falcate, 8-12 mm long. Inflorescence terminal or subterminal, (3-)7-14-flowered; peduncle 5-7(-11) cm long, slender, sparsely and shortly pilose as in the case of the pedicels, hairs unequally long; pedicels 15-25(-35) mm long, articulated near or above center or about 6-10(-12) mm below the base of the calyx. Calyx symmetrical, very pilose, 7-12 mm long, lobes elliptic-lanceolate, with scarious margins, apex abruptly narrowing to long-pointed and nearly lin-

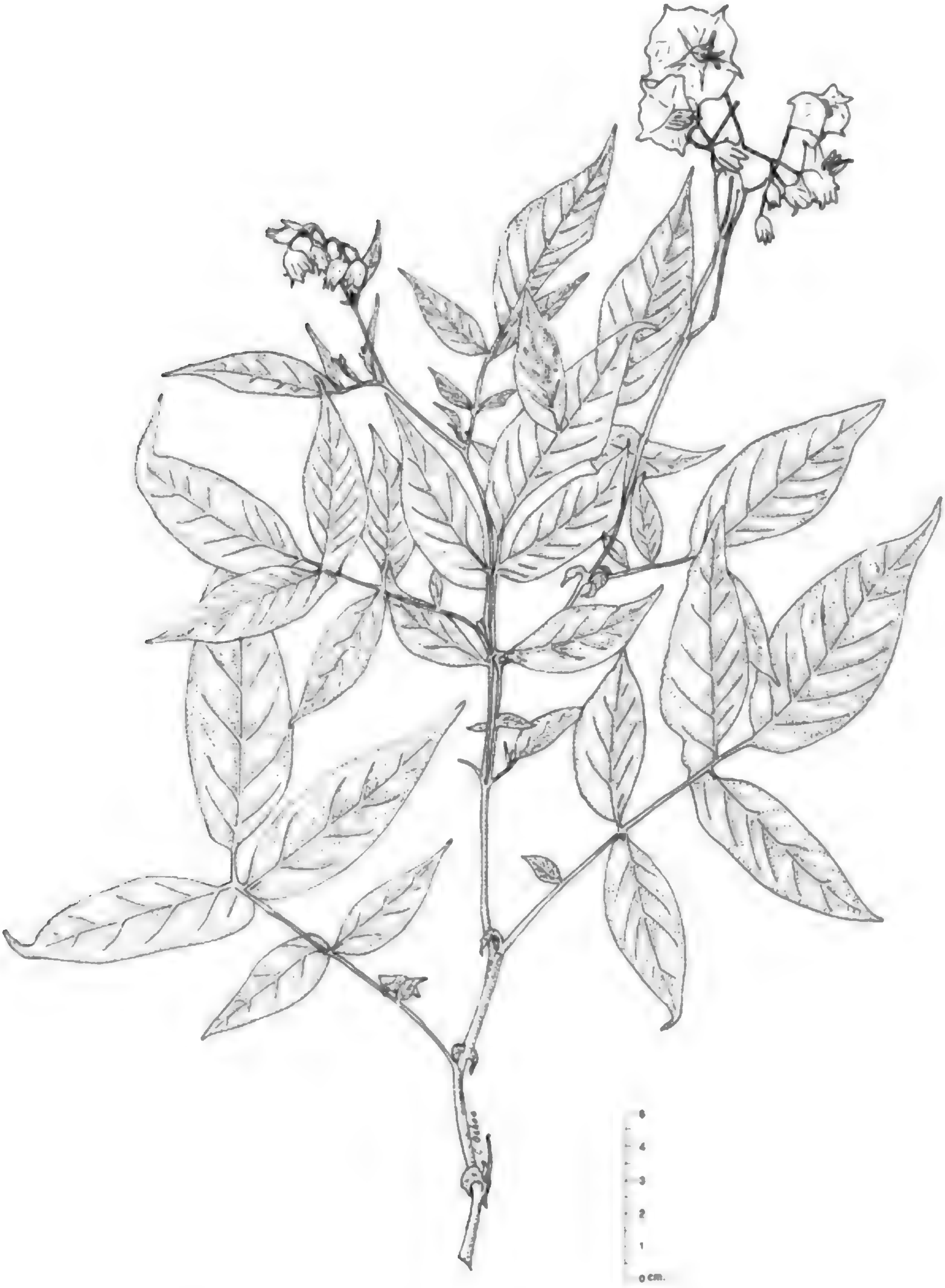


Figure 319. *Solanum marinasense* (*Ochoa 2203*, topotype).

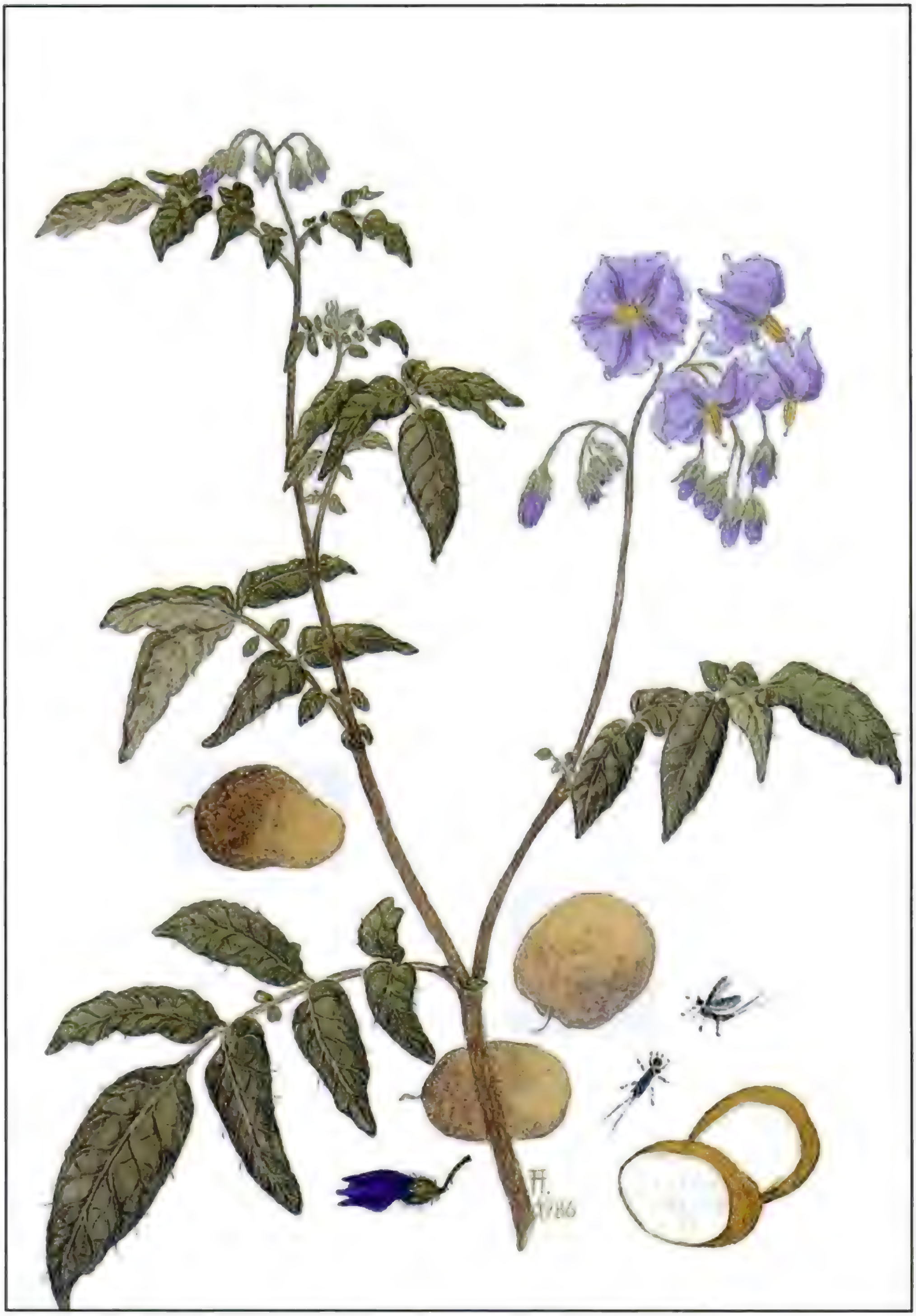


Plate XXXI. *Solanum marinasense* Vargas.

ear or subspatulate 3-5 mm long acumens. Corolla rotate, 3.0-3.5 cm in dia., blue or sky blue, with a yellow internal star, acumens 2.5 mm long, densely puberulent along the margins and externally at the tip. Anthers lanceolate, 6-7 mm long, the base deeply cordate; filaments 1.0-1.5 mm long by 0.8 mm wide, glabrous. Style 9-10 mm long, exerted 2.0-2.5 mm, densely papillose along the lower two-thirds of its length; stigma capitate. Fruit usually globose or subglobose, occasionally ovoid, 1.5-2.0 cm in dia., light green or somewhat ashy, densely speckled with white dots, not verrucose. Chromosome Number: 2n=24. EBN=2.

Local Names: The plant is called *Alkko papa* (=*Dog Potato*) and the fruit *Tamborokkoto* in Acomayo, Department of Cusco.

Type: PERU. Department Cusco, Province Calca, walls of Quebrada de Ckochocc, 2900-3000 m alt., among trees, 21 February 1944, *C. Vargas C. 4073* (CUZ, lectotype, here designated; isolectotypes LL, OCH).

Affinities

This species is unique and not closely related to any others.

Habitat and Distribution

Solanum marinasense has been collected from a variety of different habitats, including open fields, mountain slopes and foothills, rock crevices, the rock rubble of ancient ruins and the margins of cultivated fields of corn or potatoes. While appearing to prefer moist soils, this species also grows in arid, rocky or calcareous soils.

About 60% of the 140 collections that were included in this study came from mountainous regions that were situated between 2000 and 3000 m altitude. Within these climatically temperate zones, this species is associated with a wide spectrum of plant genera, including *Trifolium*, *Brassica*, *Mintostachys*, *Erdisia*, *Corryocactus*, *Opuntia*, *Tropaeolum*, *Cassia*, *Senecio*, *Salvia*, *Erodium*, *Calceolaria*, *Tillandsia*, *Prunus serotina*, *Phytolacca* and *Adiantum*. On the other hand, nearly 37% of the collections came originally from *prepuna* and *puna* zones where, at elevations between 3100 and 3700 m, the climate is considerably cooler. In these upper reaches of the Andes, *S. marinasense* has been collected with *Berberis*, *Lupinus*, *Stipa*, *Poa*, *Barnadesia*, *Puya*, *Polylepis* and *Escallonia*. It has also been collected occasionally with other tuber-bearing species, such as *S. raphanifolium*, *S. sparsipilum* or *S. bukasovii*.

Solanum marinasense is widely distributed in the Departments of Apurímac and Cusco in southern Peru (Map 28).

Specimens Examined

Department Apurímac

Province Abancay: Casinchihua, 2200 m alt., in the crevices of an ancient stone wall, annual herb, up to 0.3 m tall, corolla purple, 10 February 1939, *H. E. Stork, O. B. Horton and C. Vargas C. 10577* (F, G, NA, type collection of *S. pampasense* f. *glabrescens*). Cerro Quisapata, 2420 m alt., Abancay, among cacti, corolla sky blue, 9-10 January 1950, *C. Vargas C. 8894* (CUZ). Curahuasi, 2700 m alt., flowers purple, 23 January 1950, *C. Vargas C. 9140* (CUZ). Curahuasi, 2700 m alt., 22-23 January 1950, *C. Vargas C. 9143* (OCH). Suiluluchayoc, 2500-2600 m alt., near Curahuasi, 23 January 1950, *C. Vargas C. 9218* (CUZ, LL, OCH, type collection of *S. longimucronatum* Vargas). Vicinity of Abancay, 2800 m alt., among *tuna* plants (=*Opuntia*), 14 February 1958, *C. Ochoa 2151* (MOL, OCH, US). At km 70 of the Abancay-Chalhuanca road, 2500 m alt., flowers sky-blue, 7 February 1960, *C. Ochoa 2252* (OCH). 2 km below Curahuasi,

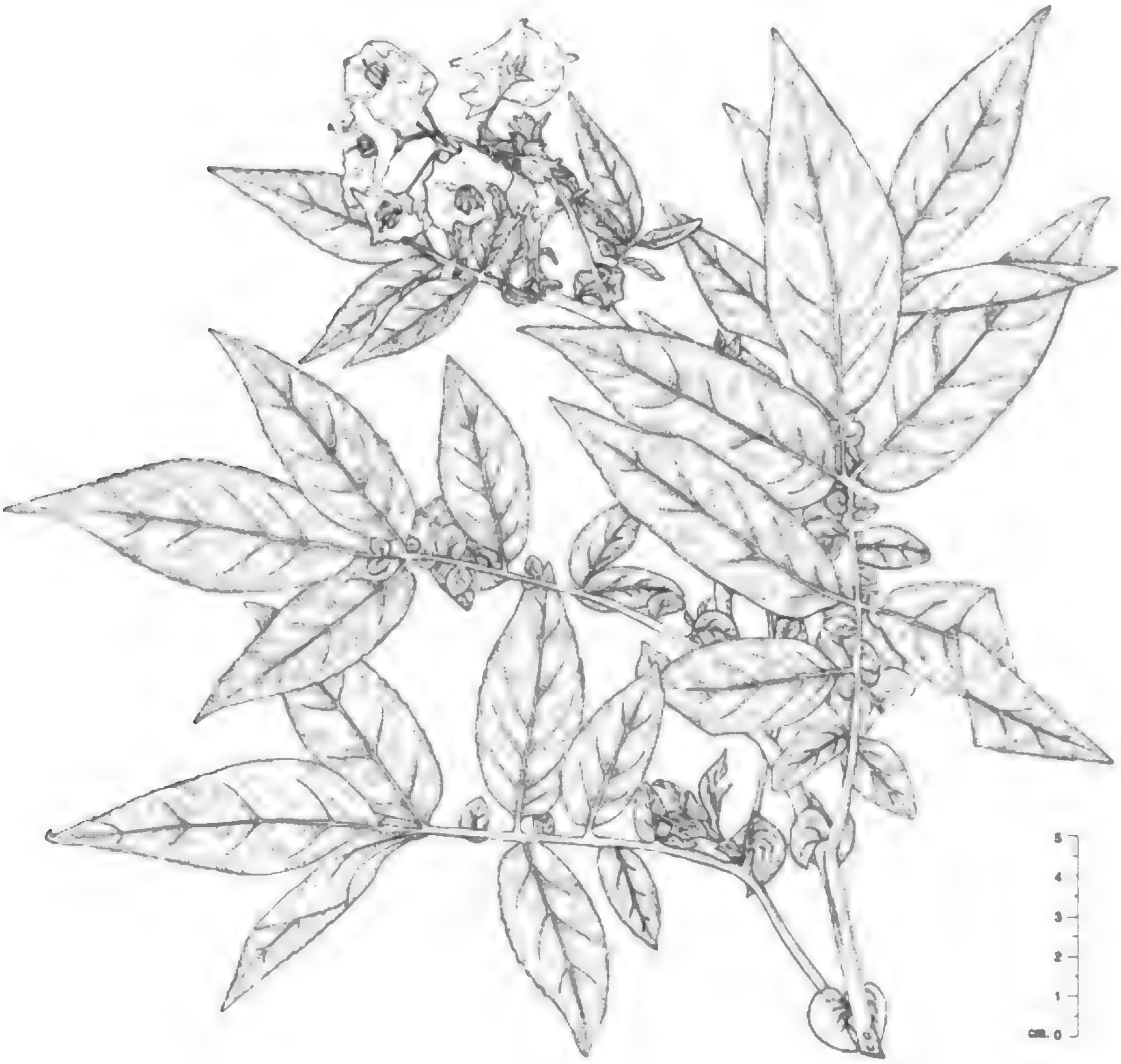


Figure 320. *Solanum marinasense* var. *dentifolium* (*Vargas 5566*, isotype).

along the Curahuasi-Cusco road, 2000 m alt., 13 February 1960, *C. Ochoa 2259* (OCH). About 10 km from Incahuasi on the Incahuasi-Cachora road, 2400 m alt., 16 February 1960, *C. Ochoa 2261* (OCH). 1-2 km below Hacienda Casinchihua, 2300-2500 m alt., in the valley of the Pachachaca River, 33 km (by air) southwest of Abancay, on a calcareous and dry rocky slope, on the western side of the hills above the Pachachaca River, 21 December 1962, *H.H. and C.M. Iltis and D. and V. Ugent 797* (F, OCH, US, WIS). Tinyayocpata, 2800 m alt., facing Curahuasi, leaves opaque, flowers lilac, 11 February 1980, *C. Ochoa 13608*, 2n=24 (OCH). Between Liwirco and Quishuar, along the route Chuñunopampa-Huanipaca, 3250 m alt., 17 March 1981, *C. Ochoa 14335* (OCH). Casinchihua, 2150-2200 m alt., berries globose, light green with very few sparsely distributed white dots, and vertical purple stripes, 30 March 1981, *C. Ochoa 14384*, 2n=24 (CIP, MOL, OCH), and *14385*, 2n=24 (CIP, MOL, OCH).

Province Antabamba: Kquilque, near Huaquirca, *ca.* 3550 m alt., 25 March 1972, *C. Ochoa 3283* (OCH).

Province Aymaraes: Pampatama, 2000 m alt., between Abancay and Casinchihua, leaving by the highway from Abancay to Chalhuanca, among forest trees and shrubs of *Acacia, Schinus molle and Phragmites communis*, 25 March 1980, *C. Ochoa 13808* (OCH). Near the Pachaconas River, 2400 m alt., above Chalhuanca, flowers blue, 25 March 1980, *C. Ochoa 13809*, 2n=24 (CIP, GH, MOL, NY, OCH, US). On banks of the Pachaconas River, near its confluence with the Antabamba River, 2400 m alt., between Alcopay and Pocohuanca, in

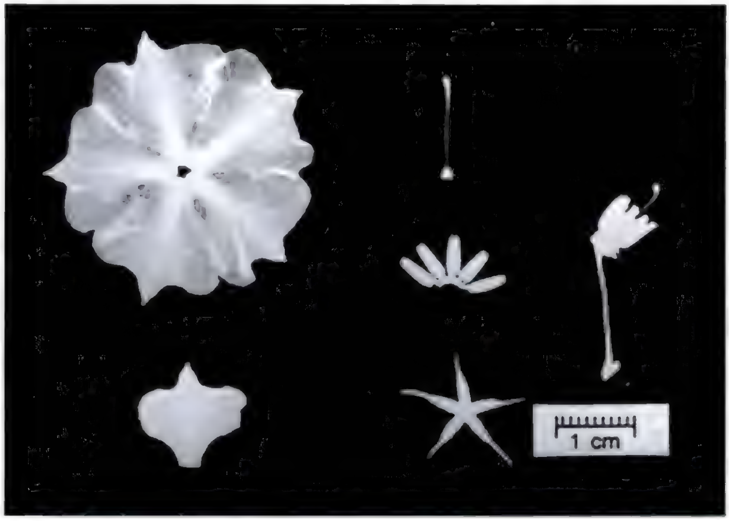


Figure 321. Floral dissection of *Solanum marinasense* (*Ochoa 11618*).

shrub thickets of *Sambucus, Monnina, Fuchsia and Nicotiana* and abundant ferns and calceolarias, 30 March 1981, *C. Ochoa 14386*, 2n=24 (OCH, plants grown in the greenhouse at CIP-Huancayo, from original seed collected at Pachaconas).

Province Cotabambas: Colecolesniyoc, 3600 m alt., about 5 km above Tambobamba, March 1980, *C. Ochoa 13673*, 2n=24 (OCH). Ayahuaycco, 3700 m alt., along the route Tambobamba-Hualgayoc, in a narrow canyon, plants 2.5 m tall, stems strong and vigorous, 29 February 1980, *C. Ochoa 13675* (OCH). Wilquipata, 3300 m alt., 1 km above Tambobamba, along the route to Colecolesniyoc, March 1980, *C. Ochoa 13677* (OCH). Durasnuchayoc, 3000 m alt., along the descent from Cotabambas to the Apurímac River, flowers dark purple, berries round, light green, flushed with light lilac at base, with a few small white dots, 1 March 1980, *C. Ochoa 13689*, 2n=24 (OCH).

Province Grau: Huacansagua, 2900 m alt., between Chuquibambilla and Vilcabamba, 26 February 1960, *C. Ochoa 2232* and *2233* (OCH). Olluputo, 1600 m alt., near Huacansagua, between Chuquibambilla and Vilcabamba, 26 February 1960, *C. Ochoa 2234* (OCH). Alccochimpa, 1700 m alt., above Olluputo, between Chuquibambilla and Vilcabamba, 26 February 1960, *C. Ochoa 2235* (OCH). Vicinity of Vilcabamba, 2500 m alt., 26 February 1960, *C. Ochoa 2236* (OCH). Vicinity of Vilcabamba, 2400 m alt., in rocky foothills, flowers blue to sky blue, 26 February 1960, *C. Ochoa 2237* (OCH). Puisho, 3000 m alt., about 5 km before Ayrihuanca, along the pedestrian trail from Vilcabamba to Ayrihuanca, 26 February 1960, *C. Ochoa 2238, 2239, 2241* and *2243* (OCH). Ulputo, 2950 m alt., heading down the pedestrian trail from Chuquibambilla to Vilcabamba,

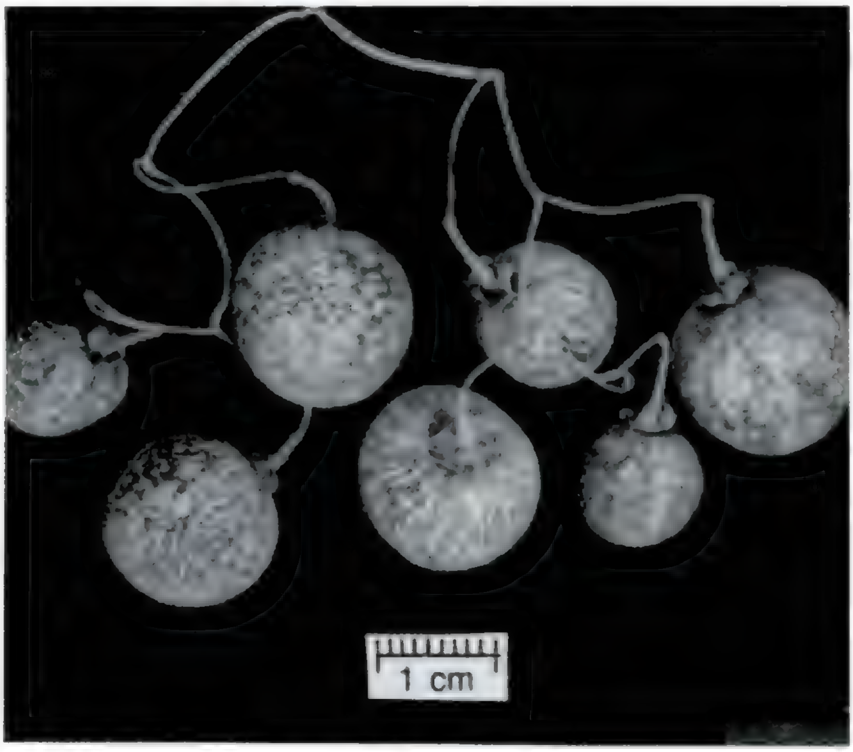


Figure 322. Fruits of *Solanum marinasense* (*Ochoa 14417*).

13 April 1962, *C. Ochoa* and *P. López Camarena 2425* (OCH). Huallhuayoc, 2800 m alt., between Chuquibambilla and Vilcabamba, 13 April 1962, C. *Ochoa 2426* (OCH). Near bridge of Chauchura, 2600 m alt., along the pedestrian trail from Chuquibambilla to Vilcabamba, about 4 km before Vilcabamba, 13 April 1962, C. *Ochoa 2427* (OCH). Vicinity of Vilcabamba, at the bottom of the pedestrian trail from Chuquibambilla to Vilcabamba, 2600 m alt., among rows of *Agave*, 14 April 1962, C. *Ochoa 2428* (OCH). Lower levels of Cerro Chaupickari, 2650-2700 m alt., facing, and to the east of Vilcabamba, between field stones and *Agave*, plant now mature but without flowers, with 3 ripe fruits, 14 April 1962, *C. Ochoa 2437* (OCH, plants grown at Universidad Nacional Agraria La Molina, Lima). Huacansagua, 2900 m alt., along the pedestrian trail from Chuquibambilla, heading down towards Vilcabamba, only very mature plants, nearly dry but in fruit, April 1972, C. *Ochoa 3654* (OCH, plants grown at Universidad Nacional Agraria La Molina, Lima). Rocky foothills of Cerro Retama Orcco, 3500 m alt., 1 km from Turpay, along the pedestrian trail to San Antonio, among shrubs of *Cassia, Agave* and *Opuntia exaltata* and herbs such as *Sonchus* and *Mintostachys*, 8 March 1980, *C. Ochoa 13736* (OCH, from the original plant), *13736A* (OCH, from plants grown in the greenhouse at Huancayo) and *13737* (CIP, OCH, from the original plant). Maltapay, 3400 m alt., between Turpay and San Antonio, associated with *Sonchus, Cassia* and *Opuntia exaltata*, 8 March 1980, *C. Ochoa 13738*, 2n=24 (OCH). Huachajray, 3380 m alt., District San Antonio, leaves vernicose, flowers sky-blue with white acumens, calyx

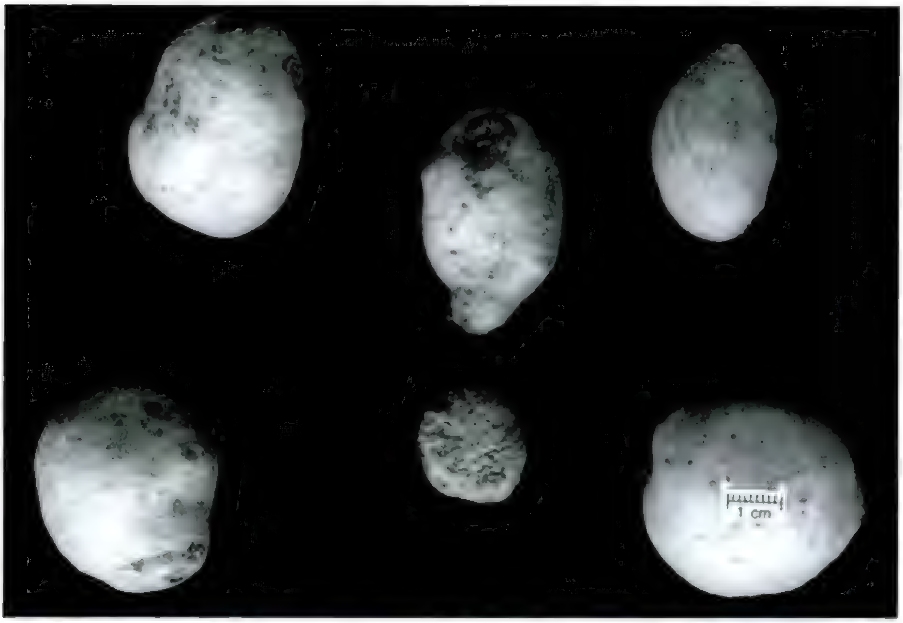


Figure 323. Tubers of *Solanum marinasense* (*Ochoa 13689*).

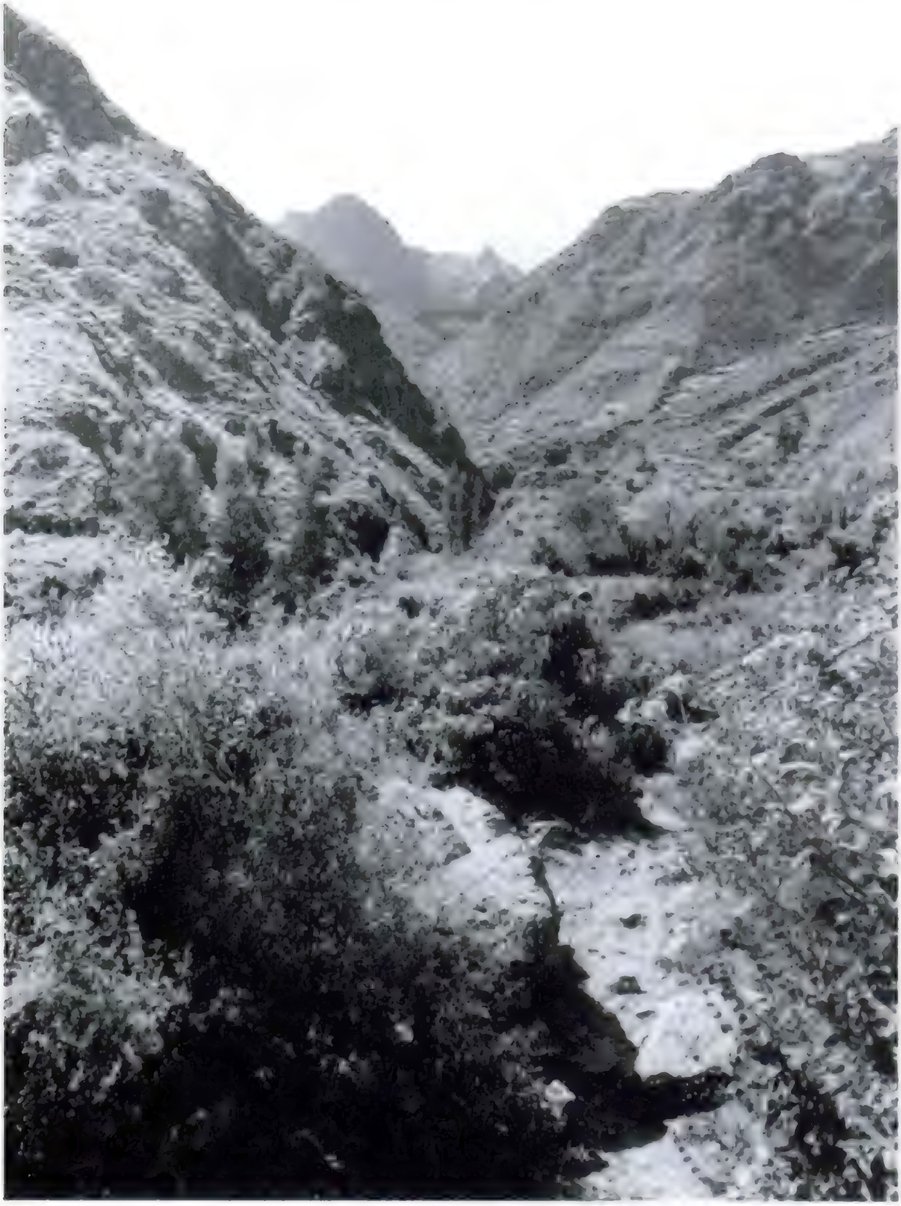


Figure 324. Quebrada de Arín, Calca, Cusco, 2900-3200 m alt., habitat of *Solanum marinasense.*

pilose with long acumens, 8 March 1980, *C. Ochoa 13740* (CIP, GH, MOL, NY, OCH, US). Molino Mocco, 3200 m alt., about 10 km from San Antonio, along the horse trail to Santa Rosa, in forests of *Schinus molle* and *Aliso* and large thickets of *Sparteum junceum*, 9 March 1980, *C. Ochoa 13745* (OCH). On the ascent from Puisho, 3320 m alt., District Airihuanca, in forests of *Schinus molle, Escallonia and Agave,* 20 March 1980, *C. Ochoa 13748* (CIP, OCH). Pucapata, 3200 m alt., heading up the railroad line from Vilcabamba to Airihuanca, flowers sky-blue, among trees of *Schinus molle*, plants of *Agave* in flower and large colonies de *Opuntia ficus-indica*, 20 March 1980, *C. Ochoa 13749* (CIP, MOL, OCH).

Department Cusco

Province Acomayo: Jatun Kero, 3700 m alt., District Pomacanchi, n.v. *Alkko Papa*, near fields of corn, potatoes and beans, associated with llaulli [*Chuquiraga* sp.], tarwi [*Lupinus* sp.], ppataquisca [= *Opuntia* sp.], achupalla [*Puya*] and muña [*Mintostachys*], February 1982, *R. Ortega 056* (OCH). Conchacalla, 3700 m alt., District Pomacanchi, n.v. *Alkko Papa* [Dog Potato], at the margins of cultivated fields of corn, potatoes and beans, among ichu [*Stipa ichu*], chinchercoma [*Mutisia*] and llaulli [*Chuquiraga* sp.], February 1982, *R. Ortega 052, 060, 072* (OCH). Luruchayocc, 3400 m alt., near km 25.5 of the Chuquicahuana-Acomayo road, associated with *Cassia, Barnadesia, Opuntia exaltata, Senecio, Salvia, Calceolaria* and *Puya*, 15 March 1984, *C. Ochoa and O. Blanco 15687* (CIP, OCH), *15688* (CIP, GH, MOL, OCH, US), *15691* (CIP, GH, OCH) and *15693A* (OCH). Mouth of the Pomacanchi Lagoon, associated with *T'ankar* (=*Dunalia* sp.) and grasses, 15-18 March 1984, *C. Ochoa 15699* (OCH). Cebadapata, 3500 m alt., near Pomacanchi, on the left bank of the stream Pomacanchi, along the edges of cultivated fields of potato and corn, within a large patch of *Agave*, associated with *Calceolaria*, *Senecio*, *Astragalus*, *Chuquiraga* and native grasses, 15-18 March 1984, *C. Ochoa and* O. *Blanco 15700* (CIP, OCH).

Province Anta: Heading up the Chinchaypujio road toward Anta, 3600 m alt., 2 March 1980, *C. Ochoa 13690A* (OCH). At km 52 of the Cusco-Abancay road, 3640 m alt., [without date of the collection], *L.E. López 1679* (CIP).

Province Calca: Slopes of the Quebrada de Ckochocc, 2900 m alt., within shrub thickets, February 1944, *C. Vargas C. 4073* (CUZ, LL, OCH, type collection of *S. marinasense*). Rocky hillsides of Tunasmocco, among cacti, 24 February 1944, *C. Vargas C. 4088* (CUZ, LL, isotype of *S. lechnoviczii* var. *xerophyllum* Vargas). Rocky hillsides of Intihuatana, Pisac, 3450 m alt., plant 40 cm tall, corolla blue-sky blue, 20 March 1945, *C. Vargas C. 5079* (LL, OCH). Pisac-Intihuatana, 3300 m alt., rocky and sandy habitat, February 1946, *F. Marín 418*

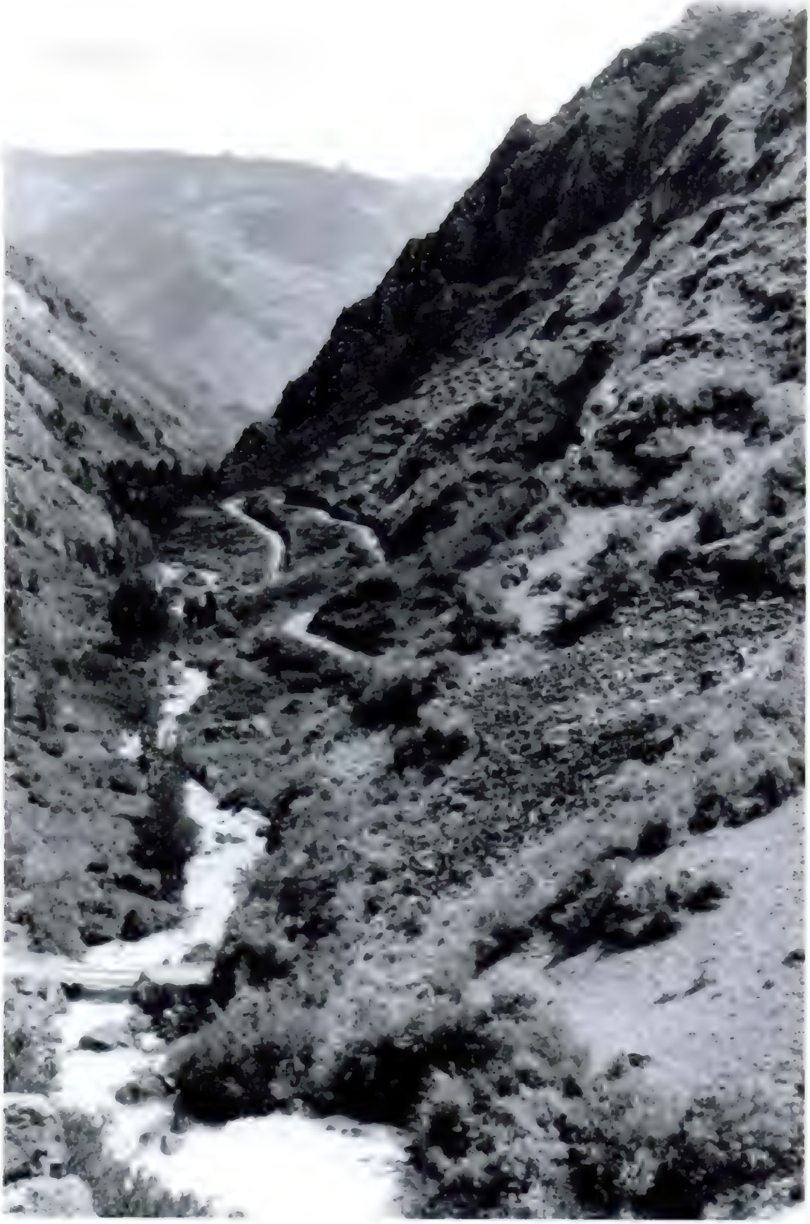


Figure 325. Quebrada de Kochoj, 3700 m alt., Calca, Cusco, type locality of *Solanum marinasense*.

p.p. (F). Sondor, Quebrada San Salvador, 3000 m alt., plant 1 m tall, among trees, 4 January 1946, *C. Vargas C. 5521* (CUZ, LL). Hacienda Hayñán or Huayñán, 2950 m alt., along the edges of a small farm, among trees, or on rocky hillsides, 10 February 1947, *F. Marín 848* (CUZ) and *849* (CUZ, OCH). Pisac, 3300 m alt., among stones, March 1950, *F. Marín 2043* (F). Near ruins of Intihuatana, Pisac, 3100 m alt., among shrubs of *Barnadesia* and *Opuntia exaltata*, plants 1 m tall, berries round to ovoid, dark green, densely marked with white dots, 24 April 1953, *C. Ochoa 2062* (OCH). Wet bushy slope 9 km from Pisac on road to Cusco, 3400 m alt., flowers up to 5 cm in dia., light blue, rotate-stellate, 27 February 1958, *D. S. Correll, E. E. Smith and C. Vargas C. P225* sheet 1, plant 1 (LL) and *225* (F). On rocky slope near Calca on road to Pisac, 3000 m alt., flowers purplish blue, 27 February 1958, *D.S. Correll, E. E. Smith and C. Vargas C. P229* (LL, NY). Arín, 2900 m alt., heading up from Hacienda Huarán to the Quebrada de Churo, very rare, 19 February 1960, C. *Ochoa 2198* (OCH). Llama-cjaya, 2900 m alt., near Arín, heading up from Hacienda Huarán to the Quebrada de Churo, 19 February 1960, C. *Ochoa 2199* and *2200* (OCH). Callis Pujyo, 2900 m alt., Quebrada de Ckochoj, near Calca, 19 February 1960, C. *Ochoa 2202* (CIP, OCH, topotypes) and *2203* (GH, MOL, OCH, US, topotypes). Morro de Tunasmocco, 2850 m alt., about 400 m south of Calca, 19 February 1960, *C. Ochoa 2204* (OCH). Arín, 3025 m alt., 6 March 1960, *C. Vargas C.*

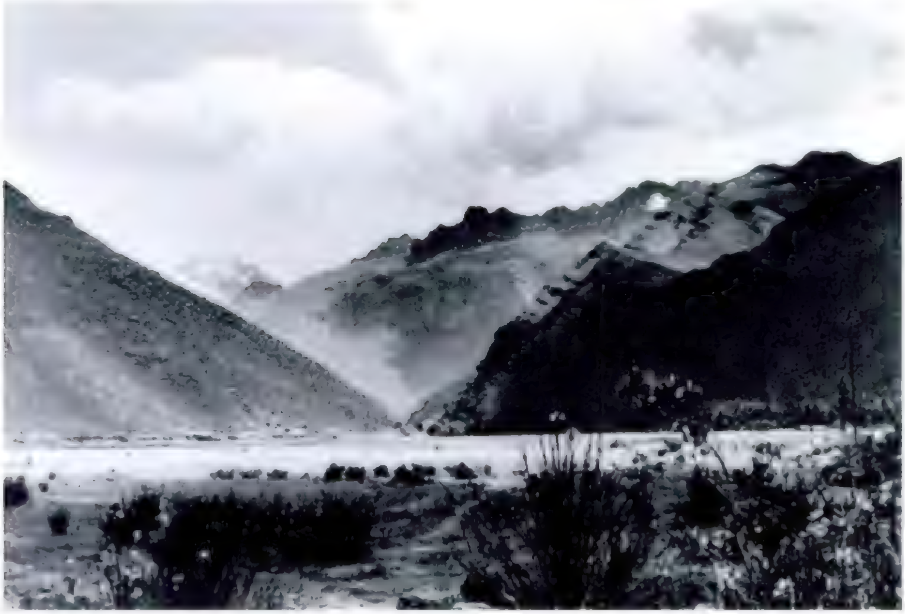


Figure 326. Valle Sagrado, 2800-2900 m alt., Cusco (Pisac, Calca and Urubamba), habitat of *S. lignicaule, S. marinasense* and *S. sparsipilum*; in the background is the great Pico de La Verónica.

13140 (WIS). Rocky quebrada and steep upper slopes of side valley of Rio Urubamba, 9 km (by road SW of Pisac on road to, and exactly at km 23 from Cusco, ca. 3800 m alt., 30 December 1962, *H.H. Iltis and D. and V. Ugent 966* (F, OCH, WIS). 9 km past Calca, on road to Pisac, 3000 m alt., on rock face, narrow leaflets, no flowers, spotted berries, 10 April 1971, *J.P. Hjerting, P.J. Cribb* and *Z. Huamán 5107* (CIP). 23 km from Cusco on road to Pisac, 3300 m alt., in wet quebrada, plants to 1.3 m, leaf 3-jugate, no flowers, 13 April 1971, *J.P. Hjerting, P.J. Cribb and Z. Huamán 5146* (CIP). Quebrada de Ckochoj, 2900 m alt., near Calca, February 1973, C. *Ochoa 3652* (OCH, plants grown at Universidad Nacional Agraria La Molina, Lima). Huilcarrayán, 3000 m alt., near Huilcacalle, District of Taray, in shrubby thickets, March 1977, C. *Ochoa 11318* (CIP, OCH) and *11618*, 2n=24 (CIP, GH, MOL, OCH, US). Between San Salvador and Huanca, 3000 m alt., near Huanca, May 1978, *C. Ochoa 12502* (OCH). Rocky hillsides of Tunasmocco, 2950 m alt., near Calca, among small shrubs of *Schinus molle* associated with cacti such as *Opuntia ficus-indica, Opuntia exaltata and Erdisia* and other xerophytes as *Dunalia lycioides, bromeliáceas* and *Tillandsias* sp., corolla violet, pedicels articulated above center, 7 March 1980, *C. Ochoa 13702*, 2n=24 (CIP, OCH). Quishuanca, 3200 m alt., between Machacancha and Chaiña Pass, flowers blue-sky blue, berries ovoid light green, with dense white dots, 14 March 1981, *C. Ochoa 14303* (CIP, GH, MOL, OCH, US). Totora, 3600 m alt., heading up the highway Calca-Amparaes, between Machacancha and the Pass or Gorge of Chaiña, on rocky talus slopes, flowers blue-sky blue, berries ovoid light green with dense white dots and 1-2 vertical purple stripes l, 14 March 1981, C. *Ochoa 14316* (OCH). Vicinity of Machacancha, 3400 m alt., among shrubs of *Cassia* and *Eupatorium*, 15 March 1981, C. *Ochoa 14317* (CIP, OCH). Between Arín and the Quebrada de Churo, near Hacienda Huarán, 2780 m alt., 28 March 1981, C. *Ochoa 14374* (OCH). Western flanks of the ruins of Pisac, on rocky hillsides, April 1981, *C. Ochoa* and *R. Ortega 14417*, 2n=24 (CIP, GH, MOL, OCH, US, plants grown in the greenhouse at Huancayo). Between Calca and Urubamba, *EBS-1887*, 2n=24 (= *PI-283080*) (CIP, OCH, plants grown at Huancayo from seeds sent from Sturgeon Bay, Wis, U.S.A.).

Province Canchis: Combapata, 3466 m alt., wild, 12 February 1946, *C. Vargas C. 5652* Leg. C.O. (CUZ, LL).

Province Cusco: Trails through the quebradas of Granja K'ayra, 3300 m alt., March 1957, *C. Ochoa 2142*, 2n=24 (OCH, type collection of *S. cuzcoense*). Trails through the quebradas of Granja K'ayra, 3400 m alt., near Cusco, 11 February 1960, *C. Ochoa 2177* (OCH).

Province La Convención: Summit of Chockequirao, 3000 m alt., near the *helipuerto*, between crevices of the ruins and on Inca walls, 19 March 1981, C.

Ochoa 14337 (OCH). Santa Rosa, 2200 m alt., between Maranpata and the Apurímac River, heading up from Cachora to Chockequirao, 19 March 1981, *C. Ochoa 14339*, 2n=24 (CIP, OCH).

Province Paruro: Occopata, 3350 m alt., on rocky land, herbaceous, 60-80 cm tall, March 1969, *C. Vargas C. 21219* (CUZ, OCH). Community of Chifia, 3000 m alt., District Huanoquite, near the river ford and along the right bank of the Molle Molle, 20 March 1972, *C. Ochoa and R. Ortega 3275 and 3276* (OCH). Community of Chifia, near river ford of the Molle Molle along the route to Tihuicti, 3000 m alt., about 200 m from the shores of the river, 20 March 1972, *C. Ochoa and R. Ortega 3277* (OCH). Between Tihuicti and Chifia, 3400 m alt., in shrubby thickets, 20 March 1972, *C. Ochoa and R. Ortega 3280* (OCH). Between Yaurisque and Paruro, 3350 m alt., plants more than 1 m tall, flowers purple, in a moist quebrada, associated with lush vegetation of shrubs and herbs, represented principally by trees of *Polylepis* sp. and *Prunus serotina*, and with *Monnina*, *Lupinus*, *Salvia*, *Calceolaria*, *Sonchus*, *Bidens* and other herbs, 1 February 1980, *C. Ochoa 13583* (OCH).

Province Paucartambo: Between Illichihua and Añobamba, near Paucartambo, Roadsides, 3100-3500 m alt., in shrubby places and on stones, corolla blue, 18-20 January 1946, *C. Vargas C. 5566* (CUZ, LL, OCH, type collection of *S. marinasense* var. *dentifolium*). Sisaspujio, 2850 m alt., near Paucartambo, n.v. *Atokk Papa*, 22 February 1960, *C. Ochoa 2213* and *2214* (OCH). Cusipata, 2950 m alt., near Paucartambo, 22 February 1960, *C. Ochoa 2215* (OCH). Ccauti, 2900 m alt., near Paucartambo, 22 February 1960, *C. Ochoa 2216* (OCH). 4.5 km SSW of Paucartambo, km 72.5 on the Huambutio-Paucartambo road, 3100 m alt., growing on a very steep valley over-looking Paucartambo, roadside, with *Schinus molle*, *Eupatorium* and *Mintostachys*, 13 March 1963, *D. and V. Ugent and C. Vargas C. 4392* sheets 1, 2, 4, 5 (WIS), *4394* sheets 1, 3 (WIS), *4395* (F) and *4397* sheets 1, 3 (WIS), sheet 2 (OCH). 3.5 km SSW of Paucartambo, km 73.5 on the Huambutio-Paucartambo road, 3100 m alt., growing on very steep valley side over-looking Paucartambo, roadside, with *Mintostachys*, *Adiantum*, *Senecio* and *Stipa*, 13 March 1963, *D. and V. Ugent and C. Vargas C. 4398* sheet 1 (WIS), and *4399* sheets 1, 2 (WIS). About 3 km NE of Paucartambo, km 80 on the Paucartambo-Pillahuata road, 2980 m alt., growing on a stone wall near the roadside, with (at base of the wall) *Spartium junceum*, *Baccharis and Berberis*, 13 March 1963, *D. and V. Ugent and C. Vargas C. 4412* sheets 1, 2, 3, 4, (WIS), and *4413* sheets 1, 2, 3, 5, 6, 7 (WIS). City of Paucartambo, 2973 m alt., growing on top of an adobe wall along the road leading to Quebrada de Kenkomayo, 13 March 1963, *D. and V. Ugent and C. Vargas C. 4416* (WIS) and *4417* (WIS). Quebrada de Kenkomayo, near Paucartambo, 3160 m alt., rocky walls of the quebrada and along footpath, with *Solanum marinasense*, *S. raphanifolium*, *S. caripense*, *Cassia*, *Tradescantia* and *Phytolacca*, 13 March 1963, *D. Ugent and C. Vargas* C. *4420* (F); *4422* (OCH); *4423,* sheet 1, 2 (WIS), and *4424,* sheets 1, 2 (WIS). At km 74.6 of the Cusco-Paucartambo road, 3200 m alt., among trees, 13 March 1963, *C. Vargas C. 014279* (CUZ, OCH). 9.5 km from Huambutio on road to Pisac, 3000 m alt., (13° S, 71° W), along the Urubamba River, growing under *Schinus molle* bordering a corn field, with *Solanum sparsipilum*, *Oxalis*, *Brassica*, *Cassia* and *Ipomoea*, also with a hybrid, possibly *Solanum marinasense* × *S. sparsipilum*, 18 March 1963, *D. and V. Ugent 4490* (F), sheets 1, 2, 3 (WIS), and *4504* (WIS). 13 km SSE of Pisac, km 14 on the Huambutio-Pisac road, 3000 m alt., steep, rocky, open slope, with *Puya*, *Adiantum*, *Calceolaria* and *Solanum caripense*, 18 March 1963, *D. and V. Ugent 4512* (WIS) and *4513* (WIS). 9.5 km from Huambutio on road to Pisac, 3000 m alt. (13° S, 71° W), growing under *Schinus molle* with *Solanum sparsipilum*, *Oxalis*, *Brassica*, *Cassia*, *Ipomoea*, *S. marinasense*, *S. caripense*, *Adiantium*, *Salvia*, *Berberis*, *Puya and Opuntia* sp., 18 March, 1963, *D. and V. Ugent 4799* (OCH). Pajlaira, 2980 m alt., 22 February 1980, *C. Ochoa 13643* (OCH, only a single plant). Between Pajlaira and Paucartambo, 2890 m alt., near Pumachaca, 22 February 1980, *C. Ochoa 13645* (OCH).

Province Quispicanchis: Eastern side of the Parina River, 3700 m alt., about 300 m from the community of Canchapata, about 10 km above Marcapata, among large rocks under trees of *quishuar* [*Buddleja* sp.], among shrubs of *Berberis* and thickets of chilca [*Eupatorium*], n. v. *Gentil Papa*, April 1975, *R. Ortega S-7A* (OCH). Chuquicahuana, 3350 m alt., May 1978, *C. Ochoa 12508* (OCH). Near Puente Chuquicahuana, 3400 m alt., at km 80 of the Cusco-Puno road, leaves vernicose, leaflets narrowly lanceolate to elliptic-lanceolate, flowers purple, 28 January 1980, *C. Ochoa 13567*, 2n=24 (CIP, OCH, MOL, US). Near Paucarpata, 3400-3450 m alt., between Puente Cusipata and Puente Chuquicahuana, on the Cusco-Puno highway, flowers light-blue, scarce, 16 February 1980, *C. Ochoa 13618, 13619* and *13620* (OCH). Quebrada de Tintinco, 3450 m alt., above Paucarpata, east of Puente Cusipata, at a detour of the Cusco-Puno trunk road, flowers sky-blue, 12 March 1980, *C. Ochoa 13722* (CIP, GH, OCH). Vicinity of Paucarpata, 3300 m alt., in a quebrada near Jaucat and Jaquijahuana, along the Cusco-Puno road, 12 March 1981, *C. Ochoa 14301* (OCH).

Province Urubamba: Pampa Kacra, 1850 m alt., roadside, thicket, 21 April 1949, *C. Vargas C. 2778* (WIS). On shaded bank about km 48 on railroad line between Cusco and Ollanta, plants up to 3 ft. tall, leaves deep green and glossy above, dull green beneath, flowers lavender, rotate, no tubers found, 3 March 1958, *D.S. Correll and E.E. Smith P258* (NY, LL sheets 1, 2). Yucay, 2700 m alt., May 1978, *C. Ochoa 12507* (OCH). Chincheros Pojpoj waterfall (aprox. 13°23'

S, 72°3' W), 3360 m alt., herb to 1 m growing on steep talus slope, producing tubers to 1.5 inches, flowers lavender, 25 January 1982, *E.W. Davis, E. Franquemont, C. Franquemont, S. King, and C. Sperling 1798* (F).

Locality Indefinite

Apurímac Valley, February 1929, *F.L. Herrera s.n.* (F). *Hje-1531B =PI-210040.1*, from plants grown at Sturgeon Bay, Wis., U.S.A., in September 1955 (LL).

Putative Natural Hybrids of *Solanum marinasense*

S. marinasense × *S. sparsipilum*

Collection 1. Leaves resembling those of *S. marinasense* but more sparsely pilose; corolla small, 3 cm in dia., deep violet; calyx asymmetrical, small, lobes broadly elliptic and apiculate; anthers long-lanceolate; pedicels articulated at the midpoint.

Department Cusco

Province Acomayo: Near Pillpinto, between Acomayo and Pillpinto, at the edge of a corn field, 15 March 1984, *C. Ochoa and O. Blanco 15697* (GH, OCH).

Collection 2. Leaves resembling those of *S. sparsipilum* but glabrescent or very sparsely pilose and the terminal leaflet larger and more broadly ovate; pedicels articulated at the midpoint; calyx symmetrical, small, lobes elliptic-lanceolate with short acumens; corolla blue-violet, rotate, small.

Province Acomayo: Acomayo, in the village park, associated with *Poa* and ornamental plants of the public garden, 15 March 1984, *C. Ochoa and O. Blanco 15698* (CIP, GH, OCH, US).

S. marinasense × *S. leptophyes*

Plant small, 30-40 cm tall; stems and leaves slender; leaves with 5 pairs of leaflets and 5-10 pairs of interjected leaflets; leaflets elliptic-lanceolate with a pointed or shortly acuminate apex, margins very finely denticulate, shortly petiolulate; corolla purple, rotate, 3 cm in dia.; peduncles very slender, 3-4-flowered, articulated near the base of the calyx. Chromosome Number: 2n=36.

Department Apurímac

Province Grau: Ranra, 4000 m alt., between Pamparackay and San Antonio, leaflets finely denticulate, flowers purple, 9 March 1980, C. *Ochoa 13744*, 2n=36 (CIP, MOL, OCH).

Breeding Potential

The results of crosses of *S. marinasense* (2n=24 and EBN=2) with diploid species of EBN=1 or EBN=2 are given in Table 82, while the materials used in these experiments are shown in Table 83.

From the figures presented in Table 82, it can be clearly seen that *S. marinasense* is incompatible in reciprocal crosses involving species having an EBN value of 1, such as *S. dolichocremastrum*, *S. hypacrarthrum* and *S. immite*, even though all the plants are of the same chromosome number. While these results may possibly be attributed to the differing EBN content of the three species, it should be noted that two of these plants are from totally different taxonomic series, namely *Megistacroloba* and *Piurana*. However, in reciprocal crosses involving this species and *S. lignicaule* of Series Lignicaulia, the latter a group with even more distant relationships to Series Tuberosa, some seeds were formed when *S. lignicaule* was used as the staminate parent, but not when this species was used as the pistillate parent. Thus, still other factors are apparently involved.

At the EBN=2 level, some success was obtained in reciprocal crosses of *S. marinasense* with *S. raphanifolium* of Series Megistacroloba, although seed set in neither direction was very high. However, with the exception of two cultivated species, excellent seed set was the rule in reciprocal crosses involving other diploid species of Series Tuberosa, including *S. aymaraesense*, *S. bukasovii*, *S. bukasovii* f. *multidissectum*, *S. coelestispetalum*, *S. goniocalyx*, *S. leptophyes*, *S. orophilum*, *S. sparsipilum* and *S. velardei*.

Lastly, varying degrees of success were obtained in reciprocal crosses of *S. marinasense* with three EBN=2 species of Series Conicibaccata, *S. laxissimum*, *S. rhombilanceolatum* and *S. urubambae*. However, no fertile seeds at all were obtained in unilateral crosses of this species with *S. peloquinianum* of Series Cuneoalata, although some parthenocarpic berries were formed.

Table 82. Fertility of *Solanum marinasense* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	LIGNICAULIA	× *S. lignicaule*	10(5)	3(1)	17(0)
24	1	MEGISTACROLOBA	× *S. dolichocremastrum*	9(6)	0(6)	0(0)
24	1	PIURANA	× *S. hypacrarthrum*	9(2)	0(2)	0(0)
24	1	TUBEROSA	× *S. immite*	9(4)	0(3)	0(0)
24	2	CONICIBACCATA	× *S. laxissimum*	21(13)	10(12)	39(250)
			× *S. rhombilanceolatum*	3(10)	1(9)	13(9)
			× *S. urubambae*	2(63)	2(17)	113(40)
24	2	CUNEOALATA	× *S. peloquinianum*	5	4	0
24	2	MEGISTACROLOBA	× *S. raphanifolium*	18(34)	7(20)	20(45)
24	2	TUBEROSA	× *S. ambosinum*	15	10	59
			× *S. aymaraesense*	5(15)	2(9)	150(31)
			× *S. bukasovii*	147(157)	123(116)	145(178)
			× *S. bukasovii* f. *multidissectum*	7(18)	4(14)	170(162)
			× *S. coelestispetalum*	70(128)	63(92)	185(126)
			× *S. goniocalyx*	54(28)	45(16)	138(130)
			× *S. leptophyes*	3(71)	3(50)	172(90)
			× *S. orophilum*	21(8)	15(5)	86(344)
			× *S. phureja*	3(8)	1(6)	25(18)
			× *S. sparsipilum*	13(24)	8(23)	106(125)
			× *S. stenotomum*	5	3	45
			× *S. velardei*	10(11)	5(8)	200(375)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 83. Collections (OCH) used in *Solanum marinasense* fertility studies.

CONICIBACCATA
S. laxissimum 11855
S. rhombilanceolatum 14406
S. urubambae 13778, 13778A, 13779, 13779A, 13787

CUNEOALATA
S. peloquinianum 13230

LIGNICAULIA
S. lignicaule 11316, 13587

MEGISTACROLOBA
S. dolichocremastrum 12074
S. raphanifolium 7610, 7619, 13654, 13695, 13728, 13735, 15628

PIURANA
S. hypacrarthrum 11308

TUBEROSA
S. ambosinum 11865
S. aymaraesense 13810
S. bukasovii 7715, 7820, 7953, 8083, 8692, 8845, 9795, 11337, 11851, 11859, 13121, 13168, 13542, 13558, 13582, 13591, 13599, 13602, 13673, 13679, 13680, 13694, 13707, 13713, 13715, 13716, 13740, 13795, 13798, 13829, 13862, 13863, 14382, 14407
S. bukasovii f. multidissectum 11843, 11868, 13720
S. coelestispetalum 7710, 7728, 13597, 13632, 13674, 13686, 13687, 13690, 13693, 13716, 13717, 13801, 14326
S. goniocalyx 00001, 14502
S. immite 14491
S. leptophyes 10876, 13671, 13729, 13730, 13731, 13733
S. marinasense 11318, 11618, 13567, 13583, 13592, 13595, 13619, 13620, 13645, 13673, 13675, 13689, 13690A, 13722, 13736, 13737, 13738, 13740, 13745, 13748, 13749, 13749A, 13808, 13809, 14303, 14316, 14339, 15687
S. orophilum 12078, 13003
S. phureja 5187, 14231
S. sparsipilum 11893, 11911, 12030, 13588, 13644, 13657
S. stenotomum 13922
S. velardei 13688

70. ***Solanum medians*** Bitt. Fedde, Repert. Sp. Nov. 11:366-367, 1912.

Figs. 327-336; Map 29; Plate XXXII.

S. medians var. *majorifrons* Bitt. Fedde, Repert. Sp. Nov. 12:149-150, 1913. Type: PERU. Department Lima, [Province Huarochiri], Tambo de Viso, *M. Martinet 232 p.p.*(P, G-photo, F-photo No. *39191*).

S. weberbaueri var. *poscoanum* Card. et Hawkes, J. Linn. Soc. Bot. 53:101-102, 1946. Type: PERU. Department Arequipa, Province Islay, *lomas* of Posco, 600-900 m alt., in sandy-rocky soils, 1 August 1940, *C. Vargas C. 2019* (CPC, CUZ, OCH).

Plant robust, bushy, extending or ascending, (16-25-)40-50(-60) cm tall, sparsely and coarsely pilose; stem usually robust, (3-)5-10 mm dia. at base, somewhat flexuous, narrowly winged, partly or occasionally entirely pigmented pinkish-violet, sparsely pilose. Plant stoloniferous and tuber-bearing; stolons thick and fleshy, white, about 1 m or more long; tubers round to ovoid or long fusiform, whitish-yellow, 3-5(-7) long. Leaves imparipinnate, short and broad, (7.5-)14.6-25.0 cm long by (4.0-)9.7-17.0 cm broad, dark green, sparsely and coarsely pilose above, more densely and finely pilose below, with 2-3(-4) pairs of leaflets and (0-)2-4 pairs of interjected leaflets, the margins shortly pilose-denticulate; terminal leaflet much larger and much broader than the laterals, (3.0-)7.5-11.0 cm long by (2-)3-4(-6) cm wide, narrowly elliptic to suborbicular or somewhat more broadly obovate-elliptic, with a pointed or abruptly pointed-attenuate apex and a rounded to cuneate base; lateral leaflets broadly elliptic to elliptic-lanceolate, with a subobtuse or abruptly and shortly pointed apex and a rounded base, or occasionally with a cuneate and oblique base, shortly petiolulate or sessile; leaflets of the first upper pair (3.0-)5.0-7.5(-8.5) cm long by (1.5-) 3.0-4.0(-5.5) cm wide, occasionally slightly decurrent about the rachis. Inflorescence terminal or lateral, cymose to cymose-paniculate, 6-10(-14)-flowered; peduncle (3-)5-12 cm long, forked, covered, as are the pedicels, with many whitish, multicellular, pointed and unequally long hairs; pedicels slightly pigmented, 20-30 mm long, articulated (3-)4-5 mm below the base of the calyx. Calyx symmetrical, 8.5-11 mm long, pigmented deep purple, usually densely pilose with coarse, long-pointed, silvery-white hairs; lobes ovate to ovate-lanceolate and abruptly narrowed to very narrow and pointed acumens, occasionally unequal in size, 3-6 mm long, with broadly scarious margins. Corolla rotate to rotate-pentagonal, deep purple or violet, (2.5-)3-4 cm in dia.; lobes with prominent but short and narrow acumens, the margins shortly pilose including the external side and along the central part of the petals. Anthers elliptic-lanceolate, (4.5-)5.5-6.5 mm long, the base distinct and shortly lobulate;

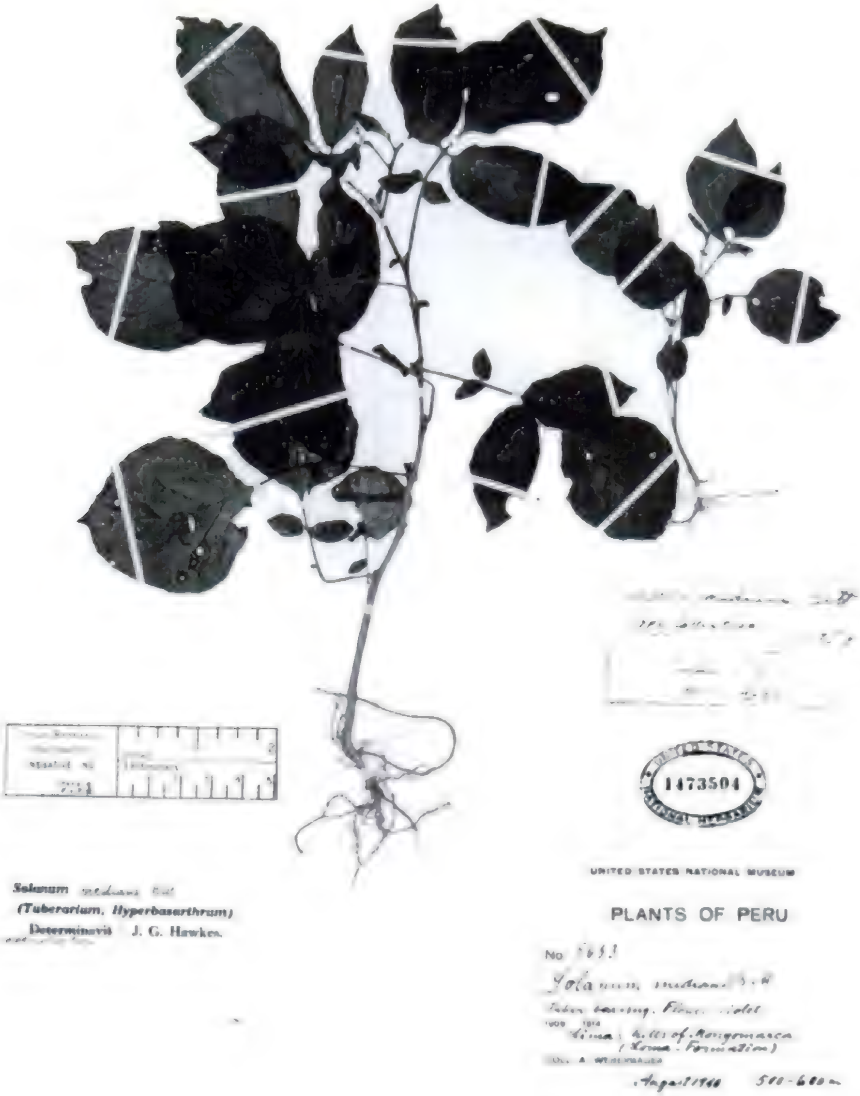

1473504
UNITED STATES NATIONAL MUSEUM
PLANTS OF PERU
No
Solanum
(Tuberarium, Hyperbasarthrum)
Determinavit J. G. Hawkes.

Figure 327. *Solanum medians* (*Weberbaueri 5683*, lectotype). Photo: Courtesy of the Department of Botany, Smithsonian Institution (US).

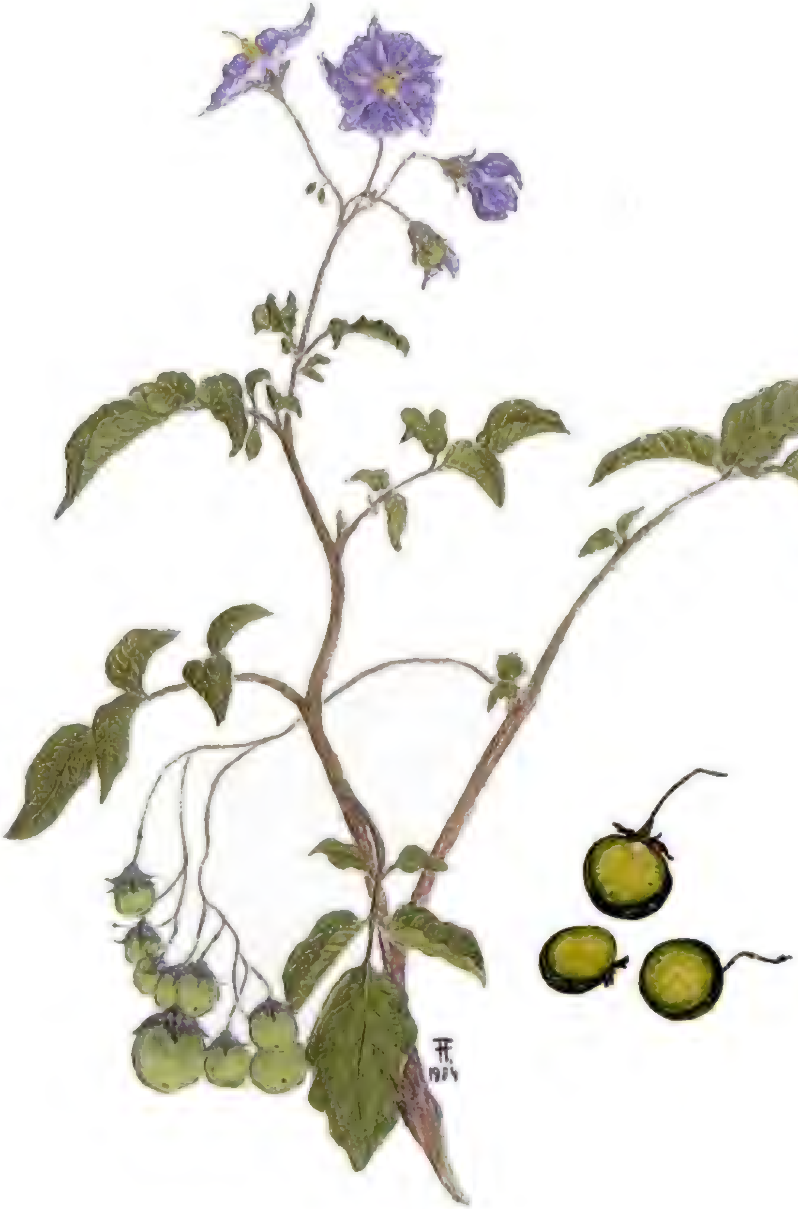


Plate XXXII. *Solanum medians* Bitt.

filaments 1.0-1.5(-2.0) mm long, glabrous. Style 9-10 mm long, slender, exerted 2-3 mm, shortly papillose along the lower two-thirds of its length; stigma claviform or subglobose, slightly cleft. Fruits usually absent by virtue of the fact that this plant is triploid. However, when produced, these are small and globular, about 8-12 mm in dia., and are either seedless or contain but 1-3 seeds. Chromosome Number: 2n=36.

Local Name: *Añaz Papa* (*Fox Potato*) in Puruchuco, Canta, Department of Lima.

Type: PERU. Department and Province of Lima, *lomas* of Mongomarca (Cerro de Amancaes), 500-600 m alt., 14 August 1910, *A. Weberbauer* (*Seler 260*) *5683* (B-destroyed; US lectotype, here designated; isolectotypes F, GH).

Bitter (1912), in his description of this species, points out that the original collector and field number of the type specimen was given as *Seler 260*. Unfortunately, this valuable specimen, which was formerly housed in the Berlin Herbarium, was destroyed in an Allied bombing raid during World War II. A photograph of the type specimen, which was kindly provided by the Field Museum of Natural History of Chicago (F), appears in Fig. 123 of the author's book on the wild potatoes of Peru (Ochoa, 1962, p. 230). Fortunately, duplicates (or isotypes) of this collection are today found in the Field Museum (F), Gray Herbarium (GH) and the U.S. National Museum (US). However, the labels on these sheets state, "*A. Weberbauer* (*Seler 260*) *5683*," and have the additional annotation, "hills of Mongomarca, *loma* formation" (the latter situated near Cerro Amancaes, Lima). A photograph of the US specimen, which is here considered as the lectotype of *S. medians*, is given in Fig. 327.

Solanum medians is a variable species. One factor that undoubtedly contributes to this condition is the fact some plants are diploid (2n=24) whereas others are triploid (2n=36). It seems quite possible that the specimens comprising the type collection of this species were triploid for the following two reasons: First, the more recent collections of this species from its type locality are all very close morphologically to the original collection; and, secondly, a chromosome count of 2n=36 has been consistently obtained from specimens that have been tested from that area.

Chromosome counts were made on more than 60 of the 175 collections of *S. medians* that were examined for this study. Thirty of these counts were made on the 100 specimens of this species that corresponded to its var. *autumnale*, and these turned out to be diploid, or 2n=24. Only 3 samples collected from the coast

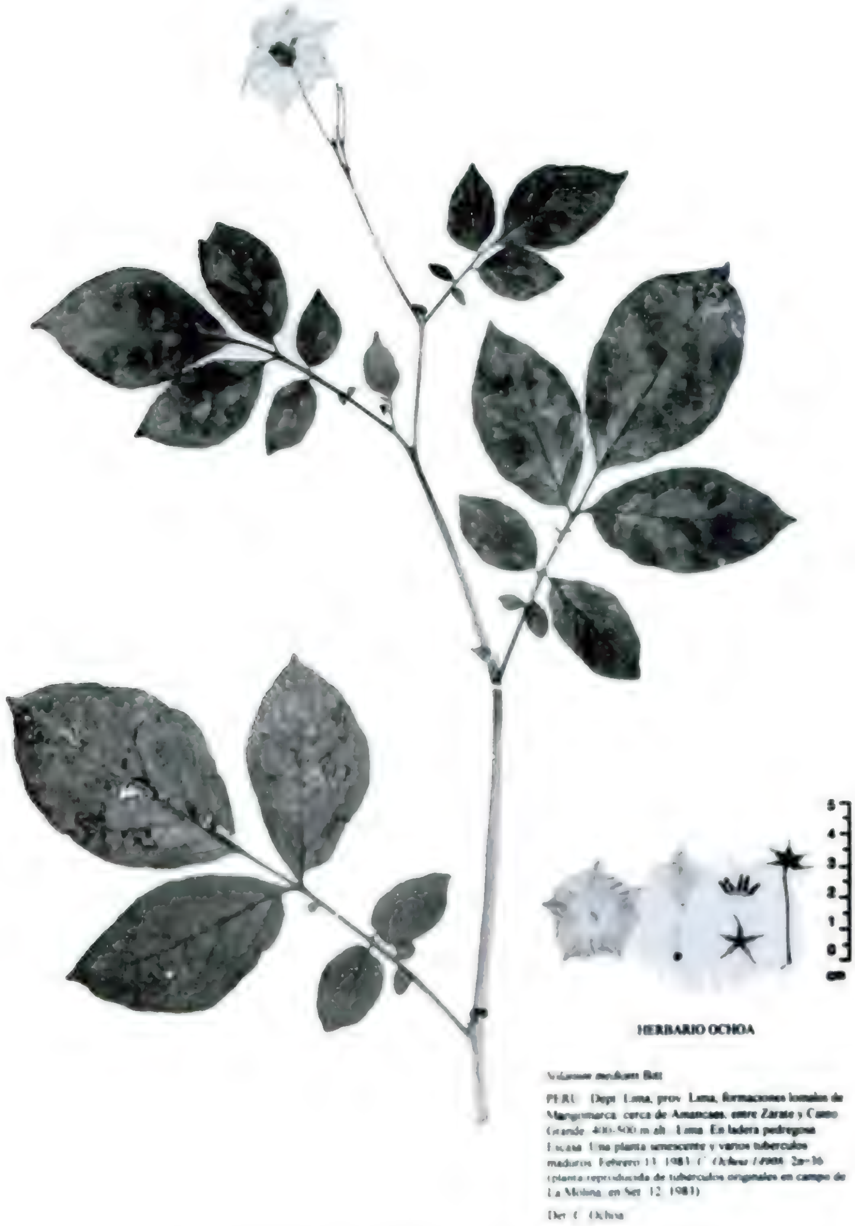


Figure 328. *Solanum medians,* 2n=36 (*Ochoa 14908*).

at elevations between 200 and 600 m had a chromosome number of 2n=24, and the closest one to the type locality of S. *medians* was situated near Pucusana, the latter near the sea and about 50 km south of Amancaes, Lima.

Triploid S. *medians* most certainly derives from diploid forms of this species as the result of the fertilization of a normal egg by a non-reduced male gamete (these forming spontaneously in nature through failure of the meiotic process). Although triploid potato plants are commonly very sterile, many are capable of surviving almost indefinitely in nature through the process of vegetative reproduction, *i.e.*, through the multiplication of tubers and stolons.

Another example of a potato species very similar in origin to that of S. *medians-3x* is S. *microdontum* subsp. *gigantophilum*, which occurs in the western mountains of the Provinces of La Rioja and Catamarca in Argentina. Okada (1981) reports a high frequency of triploid plants amongst the diploids of that area.

Bitter, as in the case of other previous authors, had very little material of either S. *medians* or S. *weberbaueri* to work with, and hence was not able to grasp the true nature of the relationship that exists between these two entities, nor was he able to comprehend the extent to which these plants varied in nature. Today, nearly a century later, it has been possible to present a more rational classification of these entities based upon the acquisition of data gathered from both nature and the experimental field and greenhouse, as well as from the cytological laboratory. All told, the evidence now suggests that S. *medians* var. *majorifrons* and S. *weberbaueri* var. *poscoanum* should be placed in synonymy under S. *medians*, while S. *weberbaueri*, S. *medians* var. *majorifrons* subvar. *protohypoleucum* and S. *medians* var. *angustifoliolum* should be placed under S. *medians* var. *autumnale*.

Affinities

Bitter considered S. *medians* to be intermediate in its characteristics between S. *weberbaueri* and S. *hypacrarthrum*, and thus he named the species *medians* in order to call attention to that fact. And, while it is true that S. *hypacrarthrum* and S. *medians* (along with its variety *autumnale*) share several important characteristics in common, including plant habit, leaf shape and enlarged terminal leaflets, the two species appear for the most part to be strongly isolated from one another genetically, giving few if any viable seeds in reciprocal crosses. However, S. *medians* is genetically and morphologically more closely related to S. *tacnaense* and S. × *neoweberbaueri* (the latter a triploid hybrid arising in crosses between S. *medians* and S. *chancayense*). This species is also similar in some ways to S. *dolichocremastrum*. Both species, for example, are coarsely pubescent and have similarly-dissected leaves, enlarged terminal leaflets and lateral leaflets that are decurrent upon the rachis. Although the author formerly considered *S. dolichocremastrum* to be synonymous with *S. medians* (Ochoa, 1962, p. 229), his more recent studies of living collections of this plant have convinced him of the authenticity of this taxon.

Habitat and Distribution

This species is distributed widely in Peru from 10 to 18° S latitude. It ranges from the low-lying coastal *loma* formations of central and southern Peru, where it occurs at elevations between 150 and 900 m, to the western slopes of the Andes, where it grows from middle elevations (ca. 1500 m) to a maximum of 3500-3700 m (Map 29). Because of the disparity in elevation between these two regions, the growing season for *S. medians* actually spans two distinct times of the year. Along the coast, this species is found during the winter season, which lasts from May to October, while in the mountains it is found during the rainy season, which lasts from November to March or April.

In the fog-induced and species-poor *loma* formations of the coast, this species grows in association with two bulbous genera, *Hymenocallis* and *Stenomesson*; various grass species, including *Poa*; several nightshades, including *S. ferreyrae*, *S. montanum* and *S. multifidum*; and, various species of *Nolana*, *Islaya*, *Datura*, *Physalis* and *Lycopersicon*. In the quebradas and higher mountains of the western Andean slopes, on the other hand, it grows in association with *Salpichroa* and *Schinus molle*, or occasionally with *S. bukasovii* or other wild tuber-bearing species.

Specimens Examined

Department Arequipa

Province Camaná: *Lomas* of Camaná, 500-600 m alt., between km 163 and 164, in sandy foothills, flowers purple, 10 November 1952, *R. Ferreyra 8835* (LL, USM). Quebrada del Toro, 900-1000 m alt., in the *lomas* of Camaná, between km 150 and 160 of the Panamerican highway, along the Arequipa-Camaná road, 20 September 1958, C. *Ochoa 2162*, 2n=36 (OCH).Qebrada del Toro, 900-1000 m alt., *lomas* of Camaná, 27 October 1976, C. *Ochoa 11267*, 2n=36 (CIP, OCH, US).

Province Caravelí: *Lomas* of Atiquipa, 600 m alt., 22 September 1958, *C. Ochoa 2161* (OCH). Huertayocc, 500 m alt., *lomas* of Atico, September 1977, *C. Ochoa and A. Salas 11767*, 2n=36 (CIP, GH, OCH, US). Infiernillo, 600 m alt., in the *lomas* of Atiquipa, among trees of *Caesalpina spinosa* and thickets of

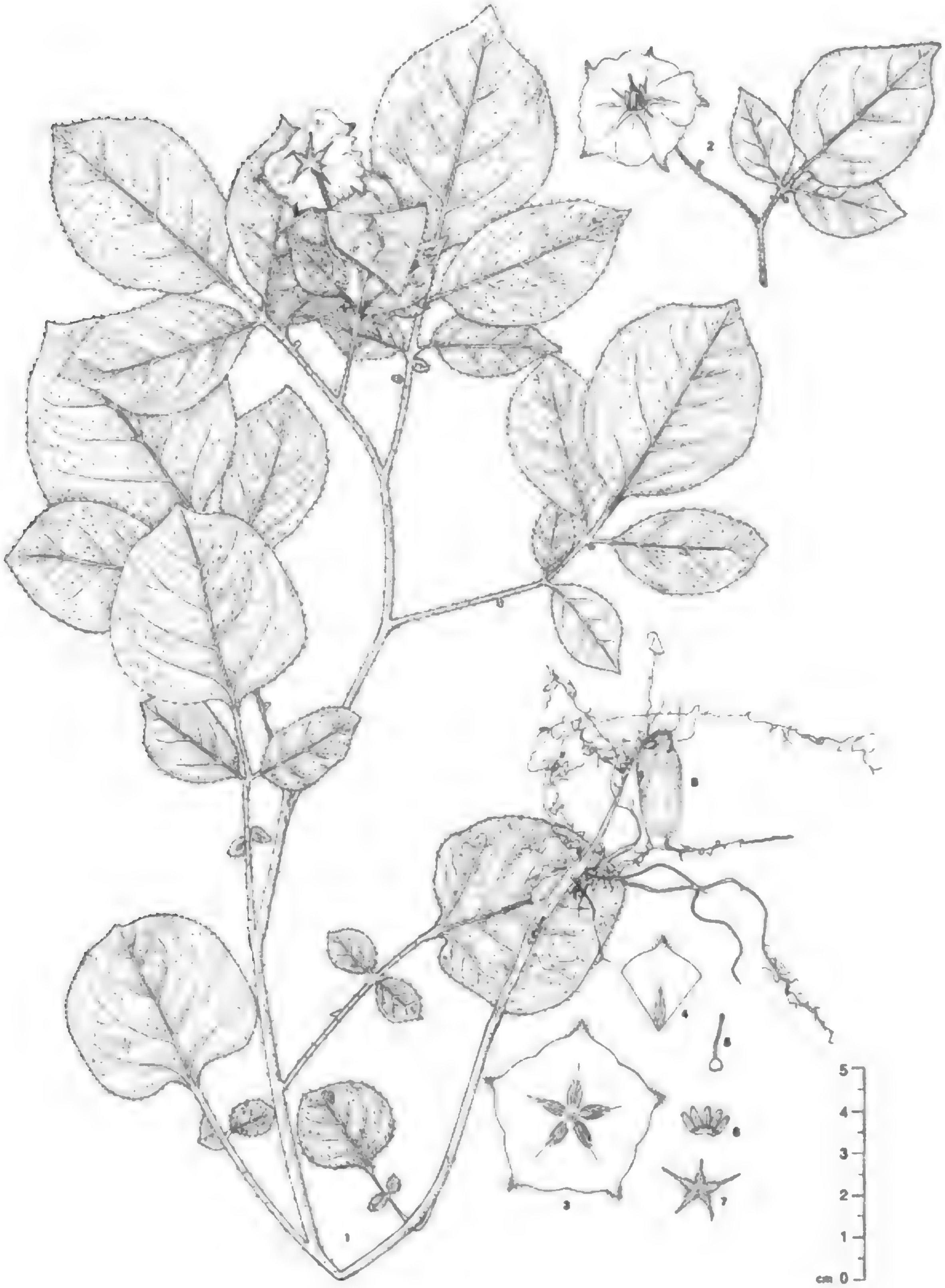


Figure 329. *Solanum medians*, 2n=36 (*Ochoa 3036*), Lomas de Atocongo, near Lima.

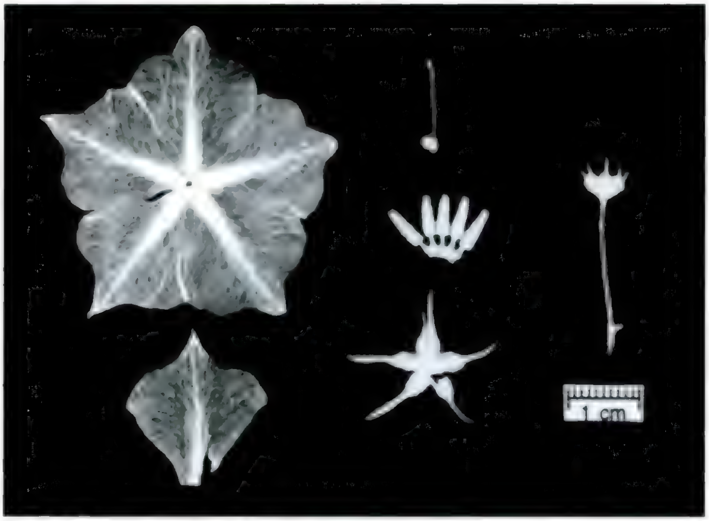


Figure 330. Floral dissection of *Solanum medians*, 2n=36 (*Ochoa 11261*), specimen collected at the Lomas de Posco, near Cachendo, 500-900 m alt., Islay, Arequipa.

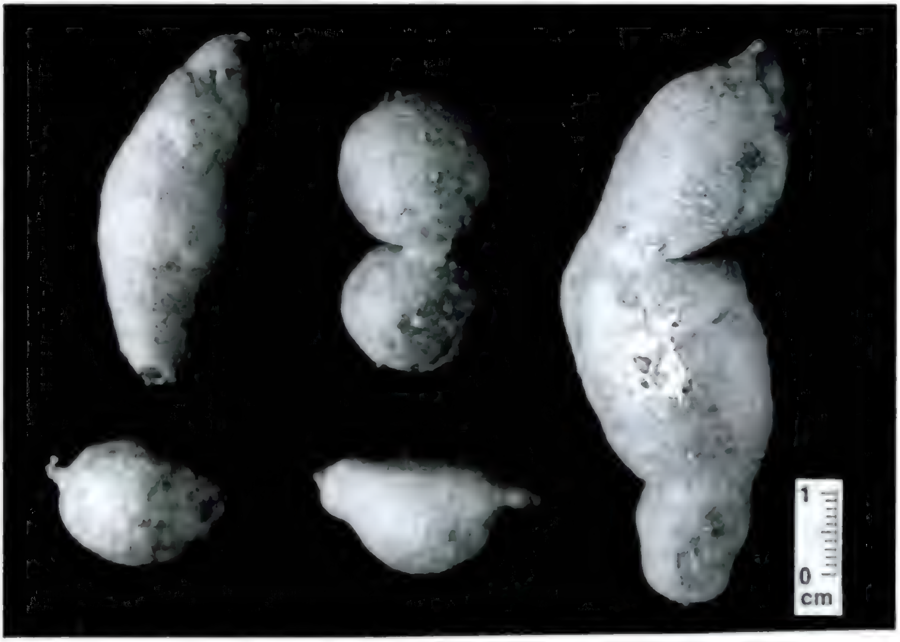


Figure 331. Tubers of *Solanum medians*, 2n=36 (*Ochoa 11267*), collected at the Lomas de Camaná, Quebrada del Toro, 900 m alt., Arequipa.

Datura, *Physalis* and a non-tuberous *Solanum*, various composites, abundant, its distributed up to Malco and Tocota at an elevation of 2000 m, n.v. *Papa de Zorro*, December 1982, *C. Ochoa and A. Salas 14900*, 2n=36 (CIP, F, GH, MOL, OCH, NY, UNTC, USM, US).

Province Islay: Posco, 650 m alt., 24 November 1923, *E. Guenther and O. Buchtien 98* (HBG). Cachendo, 900 m alt., 5 October 1923, *E. Guenther and O. Buchtien 98a* (HBG). *Lomas* of Posco, 500-900 m alt., railway station, plants to 45 cm tall, scarce, sandy-rocky habitat, 1 August 1940, *C. Vargas C. 2019* (CUZ, CPC, OCH, type collection of *S. weberbaueri* var. *poscoanum*). *Lomas* of Posco, 500-600 m alt., about 10 km from Cachendo, vicinity of Quebrada de Cachullo, associated with *Nolana sedifolia* and a globose cactus of *Islaya* sp, plants very mature, flowers light purple, tubers large, 4-6 cm long, oval-flattened or compressed, in sandy soil, among rocks, 26 October 1976, *C. Ochoa 11261*, 2n=36 (CIP, OCH, topotypes of *S. weberbaueri* var. *poscoanum* and CIP, OCH, plants grown in greenhouse at La Molina, Lima). Lomas of Posco, 500-600 m alt., plants very mature or near maturation, very scarce, 27 October 1976, *C. Ochoa 11265*, 2n=36, topotype of *S. weberbaueri* var. *poscoanum* (CIP, OCH, from original collection; and OCH, from plants grown in greenhouse at La Molina, Lima).

Department Huancavelica

Province Castrovirreyna: Jatun Corral, 2900 m alt., on the left bank of the Chiris River, near Ticrapo, on the Pisco-Huancavelica road, via Ticrapo, scarce, plant very young, without flowers, *C. Ochoa s.n.* (OCH).

Department Lima

Province Cajatambo: Huaylancana, 3600 m alt., about 3 km east of Cajatambo, 31 January 1979, *C. Ochoa 13141*, 2n=36 (CIP, GH, F, MOL, OCH, US), and *C. Ochoa 13142*, 2n=36 (CIP, OCH, from plants grown in the greenhouse at La Molina, Lima and in the greenhouse at Huancayo). Susucalla, 3700 m alt., about 5 km east of Cajatambo, 31 January1979, *C. Ochoa 13144*, 2n=36 (CIP, OCH, from plants grown in the greenhouse at Huancayo). Pilucancha, 3600 m alt., between Utcas and Cajamarquilla, District Huancapón, on a rocky hillside, associated with herbaceous and shrubby vegetation such as *Muña* (*Minthostachys* sp.), *Marcku* (*Erodium* sp.) various species of grasses including *Poa*, and cylindrical stem cacti (*Opuntia exaltata*), 12 April 1982, *C. Ochoa 14668*, 2n=36 (CIP, OCH).

Province Canta: Ranchaní, 2300 m alt., above the hamlet of Puruchuco, on dry, rocky land, 11 April 1960, *C. Ochoa 2294* (OCH). Lachaqui, 3700 m alt., Agua Bendita, in rocky foothills and steppe grassland, specimen poor, sterile, n.v. *Papa de Añaz* [*Papa de zorrino*], 19 May 1973, *G. Vilcapoma 180* (OCH). Vicinity of Canta, 3000 m alt., along the highway to Pariamarca, in sandy-clay soil or on stones, flowers purple, 13 April 1974, *G. Vilcapoma 213-1* (CIP, OCH), *213-2* (CIP), *213-3* (OCH), and *214-4* (OCH). Canta, 2700 m alt., among herbaceous vegetation, 6 April 1979, *C. Ochoa 13261*, 2n=36 (CIP, MOL, OCH). Tambobamba, 2200 m alt., above Tambo, along the Huayopampa-Acos road, District of Acos, near the right bank of the Chancay River, among large rocks, near *Solanum wittmackii*, *S. corymbosum*, *Lycopersicon* sp. and trees of *Schinus molle*, March 1982, *C. Ochoa and A. Salas 14629*, 2n=36 (OCH). Puruchuco 2350 m alt., on the road to Apán, on rocky hillsides, mountain *caducifolio*, flowers violet (purple), 2 April 1994, *R. Moreyra and G. Vilcapoma 3044* (MOL, OCH). Province Cañete: Corral Lomacino, 250 m alt., in the *lomas* of Quilmaná, about 12 km north of Cañete, 29 August 1952, *C. Ochoa* 1810 (OCH). *Lomas* of Quilmaná, District Asia, *ca*. 500 m alt., 19 August 1995, *D. Bauman s.n.* (OCH).

Province Huaral: Chancay, 1778-1788, *H. Ruiz and J. Pavon 8/90 p.p.*, plant-2, "Patatas del Peru" (MA *p.p.*). Teatinos, 300 m alt., near Huaquería, about 5 km northwest of the *lomas* of Lachay, in sandy and rocky soil, scarce, plant 25 cm tall, flowers blue-violet, 12 August 1948, *C. Ochoa 566* (OCH).

Province Huarochirí: Between Matucana and San Mateo, 2400-2600 m alt., on the Central Highway, in rocky ground, mountain foothills, flowers purple, 13 February 1949, *R. Ferreyra 5402* (OCH, USM). Near San Mateo, 2800-2900 m alt., on the Lima-Huancayo highway, rocky land, mountain foothills, flowers purple, 25 March 1950, *R. Ferreyra 6961* (LL, MOL, OCH, USM). El Infiernillo, Canyon of the Rimac River, 3200 m alt., on the Lima-Oroya highway, on rocky talus slopes, near railroad bridge, 1 April 1953, *C. Ochoa 2054* (OCH). *Lomas* of Lachay, 260 m alt., [85 km north of Lima], 17 October 1970, *Z. Huamán 073* (CIP), and August 11, 1971, *Z. Huamán 238* (CIP, OCH). Oquibamba, 2800 m alt., 8 miles past the town of Huinco, in a rocky habitat, 29 February 1972, *Z. Huamán, F. de la Puente, J. Bryan and H. Ross 294-A* (CIP, OCH). San Mateo, *ca*. 3400 m alt., near km 99 of the Central Road, 14 April 1972, *Z. Huamán, F. de la Puente, J. Bryan and H. Ross 306* (CIP, MOL, OCH, USM, US). Near Cumpe, 1850 m alt., heading up from Santa Eulalia to Seque and Huinco, on rocky hillsides, flowers deep violet, March 1973, *C. Ochoa 3882*, 2n=36 (OCH). Pacomanta, 3760 m alt., along the Lima-Huarochirí road, on rocky talus slopes of the road, 15 April 1974, *C. Ochoa 5222*, 2n=36 (OCH). Near San Mateo, 3400 m alt., on the Central Highway Lima-Oroya, March 1975, *C. Ochoa 7433*, 2n=36 (OCH). Above Langa, 2300 m alt., on the Lima-Huarochirí highway, via Cieneguilla-Sisicaya, 2 March 1977, *C. Ochoa 11319*, 2n=36 (CIP, OCH). Near Huinco, 2200 m alt., heading up from Chosica by the Quebrada de Santa Eulalia, among stones, 21 February 1978, *C. Ochoa 11878*, 2n=36 (CIP, OCH, US).

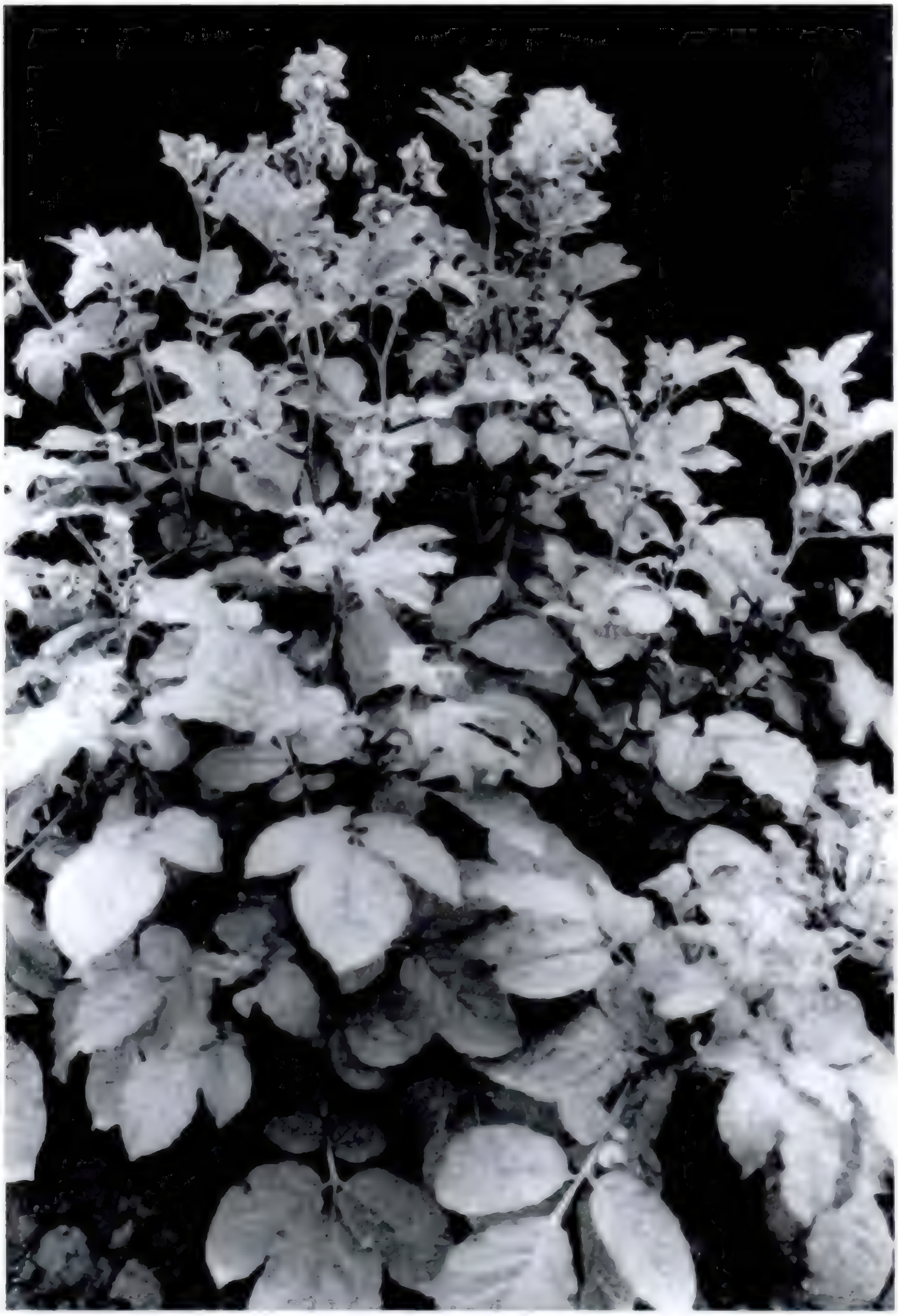


Figure 332. Living plant of *Solanum medians*, 2n=36 (*Ochoa 14908*), propagated at La Molina from tubers collected at its type locality.

Near the Seque dam, 3100 m alt., above Huinco, Quebrada de Santa Eulalia, 21 February 1978, *C. Ochoa 11883*, 2n=36 (CIP, OCH). Surco, 2220-2240 m alt., on the Central Highway, 10 April 1978, *C. Ochoa 12049*, 2n=36 (OCH, floral dissection) and *12050*, 2n=36 (OCH, from plants grown in the greenhouse at Huancayo). San José de Chorrillos, 2220 m alt., April 1978, *C. Ochoa and A. Salas 12532*, 2n=36 (OCH). Saquinanga, 2000 m alt., above Antioquia, on the road to Langa and Huarochirí, on steep hillside, rocky, flowers purple, April 1978, *C. Ochoa and A. Salas 12533*, 2n=36 (CIP, MOL, OCH). Opika, *ca*. 3000 m alt., between Seque and Huinco, heading up from Chosica by the Quebrada de Santa Eulalia, 16 February 1979, *C. Ochoa 13187*, 2n=36 (CIP, OCH). Santa Eulalia road, NE of Huinca, roadside remnants of shrubby vegetation, steep hills, 2350-2450 m alt., 11°50' S, 76°40' W. Viny herb, flowers blue violet, March 7, 1982, *A. Gentry & D. Smith 36121* (MO). Near Pacomanta, 3400 m alt., heading up the Lima-Huarochirí highway, via Cieneguilla-Sisicaya, March 1982, *C. Ochoa 14613*, 2n=36 (CIP, F, OCH). Huaricancha, 2500 m alt., District Santiago de Tuna, tubers oval-flattened to round, white, 3-4 cm long, 21 April 1982, *C. Ochoa 14730*, 2n=36 (OCH). Near San Mateo, 3200 m alt., on the Central Highway Lima-Oroya, 3 May 1983, *C. Ochoa 15209*, 2n=36 (CIP, OCH). At km 89 of the Lima-La Oroya central road, between Matucana and San

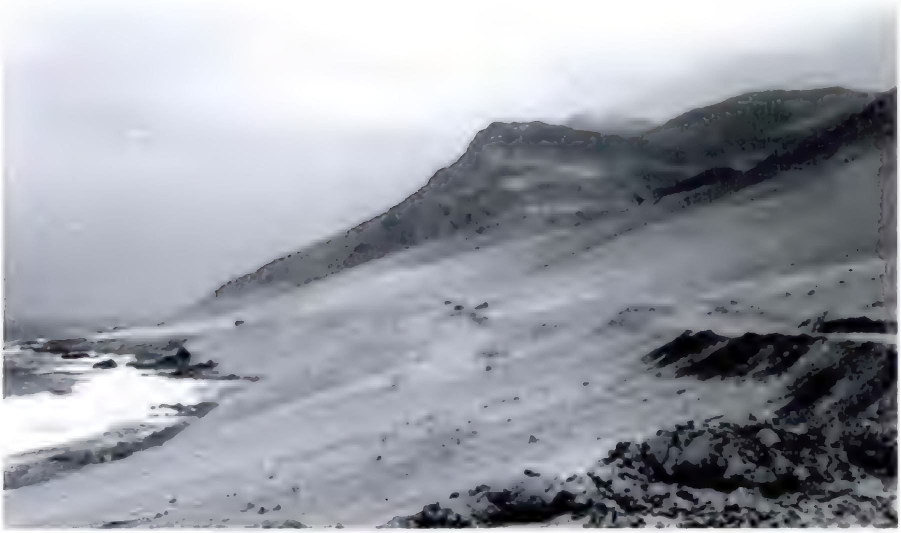


Figure 333. Habitat of *Solanum medians*, Lomas de Ilo, Moquegua, near the Pacific Ocean, 150-350 m alt.

Mateo, 4 January 1984, *C. Ochoa 15297*, 2n=36 (OCH). Tambo de Visa [Tambo de Viso], without date, *M. Martinet 232 p.p.* (P, type collection of *Solanum medians* Bitt. var. *majorifrons* Bitt., photo in F).

Province Lima: Cerro de Amancaes, near Lima. July 1910, *Seler 260=A. Weberbauer 5683*, hills of Mongomarca, *loma* formation 500-600 m alt. August, 1910 (B, destroyed, F, GH, GOET-drawing only, US, type collection of *Solanum medians*). *Lomas* of the Quebrada de San Juan, 400 m alt., near Atocongo, about 5 km south of Lima, in sandy soil, 15 August 1958, *C. Ochoa 2160*, 2n=36 (OCH, US). In *loma* formations, 1 km east of Atocongo, 350 m alt., in sandy-rocky soils, 21 August 1971, *C. Ochoa 3036*, 2n=36 (CIP, OCH, USM, US). *Lomas* of Caringa, 450 m alt., about 10 km east of San Bartolo and about 60 km south of Lima, on rocky slopes, 21 August 1971, *C. Ochoa 3037*, 2n=36 (OCH). *Lomas* of Manchay, 350 m alt., District of La Molina, northeast of La Arenera de La Molina, on the La Molina-Cieneguilla highway, scarce, in rocky land, 8 Sep-

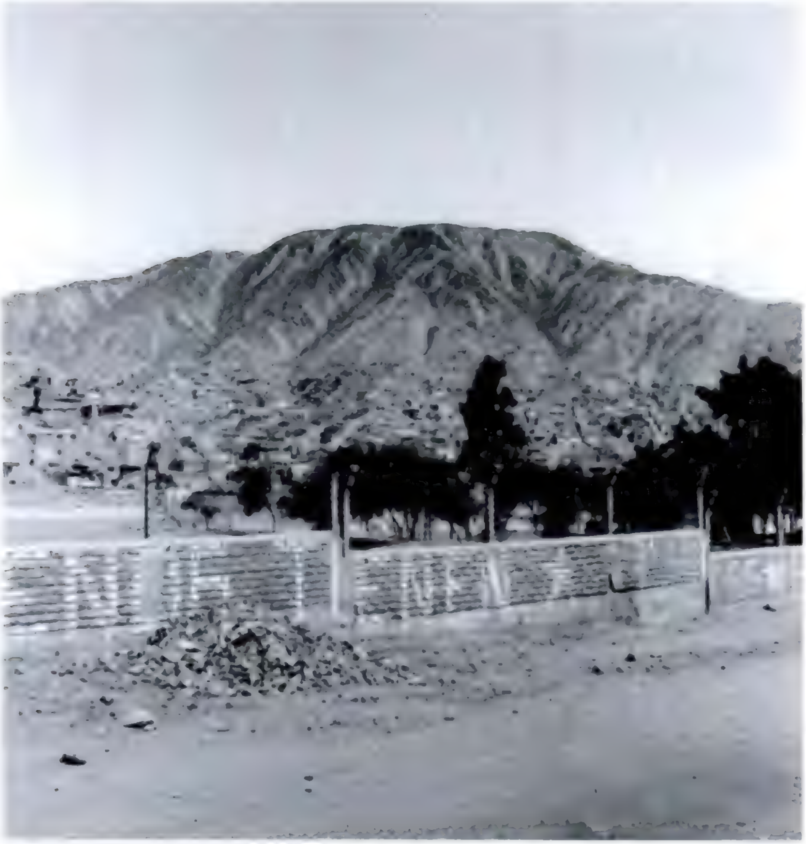


Figure 334. Lomas de Mongomarca, near Amancaes, Lima, type locality of *Solanum medians*, today strongly deprecated. Photo: June 1988.

tember 1977, *C. Ochoa 11764*, 2n=36 (CIP, OCH). *Lomas* of Caringa, 350 m alt., 9 km east of San Bartolo and 60 km south of Lima, in rocky soil, September 1978, *C. Ochoa 13035*, 2n=36 (CIP, MOL, OCH). In *loma* formations, 500 m alt., about 6 km east of Lurín and 35 km south of Lima, on rocky talus slopes, September 1978, *C. Ochoa 13036*, 2n=36 (CIP, OCH, US). *Loma* formations of Mongomarca, near Amancaes, between Zárate and Canto Grande 400-500 m alt., on rocky hillsides, scarce, one senescent plant and some mature tubers, 13 February 1983, *C. Ochoa 14908*, 2n=36 (topotype OCH) and (CIP, MOL, OCH, USM, US, plants propagated at La Molina, Lima, 12 September 1983, from the original Mongomarca tubers).

Province Yauyos: Paluche, *ca.* 2400 m alt., Jurisdiction of Cacra, 7 April 1975, *D. Bauman s.n.* (OCH). Heading up the path to Lashuay, near 2900 m alt., about 7 km west of the Huampará-Quinches road, flowers blue, 10 March 1978, *Rainer Zachman s.n.* (OCH).

Province Indefinite: Lima, 1868-1871, *Dr. Barranca 208 p.p.* (W, mixed with *S. wittmackii*).

Department Moquegua

Province Moquegua [Ilo]: *Lomas* of Ilo, 350 m alt., tuber-bearing, somewhat common in the high, sandy part of the *loma* formations, flowers bluish-purple, 11 August 1957, *O. Velarde 6157* (MOL, OCH, USM, US).

Province Ilo: *Lomas* of La Buitrera, 350-400 m alt, 25 km (in a straight line) south-southeast of Ilo and 2 km north of Cerro Huaca de La Luna, 29 October 1976, *C. Ochoa 11268*, 2n=36 (CIP, OCH, US), and *11269*, 2n=36 (CIP, OCH, US).

Breeding Potential

The results of crosses of *S. medians-3x* (2n=36) with diploid species (2n=24, EBN=1 or EBN=2), triploids (2n=36), tetraploids (2n=48, EBN=4), and pentaploids (2n=60, EBN=4) are given in Table 84, while the materials used in these experiments are shown in Table 85.

Though triploids are not generally known for their fertility, some 2n=36 clones of *S. medians* produce modest quantities of pollen.

In the two unilateral crosses involving triploid *S. medians* and the diploid EBN=1 species, *S. lignicaule* of Series Lignicaulia and *S. immite* of Series Tuberosa, no seeds were obtained. Similarly, no success at all was experienced in the reciprocal crosses involving this species and the EBN=1 Series Piurana species, *S. hypacrarthrum*. However, reciprocal crosses of *S. medians* with diploid *S.*

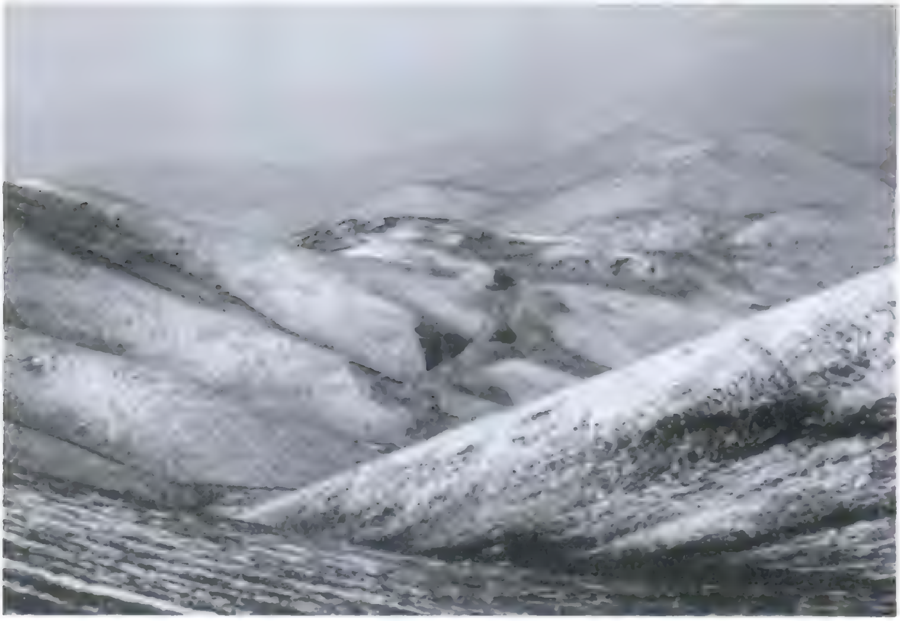


Figure 335. Habitat of *Solanum medians*-3x, Lomas de Posco, 500-900 m alt., Islay, Arequipa.

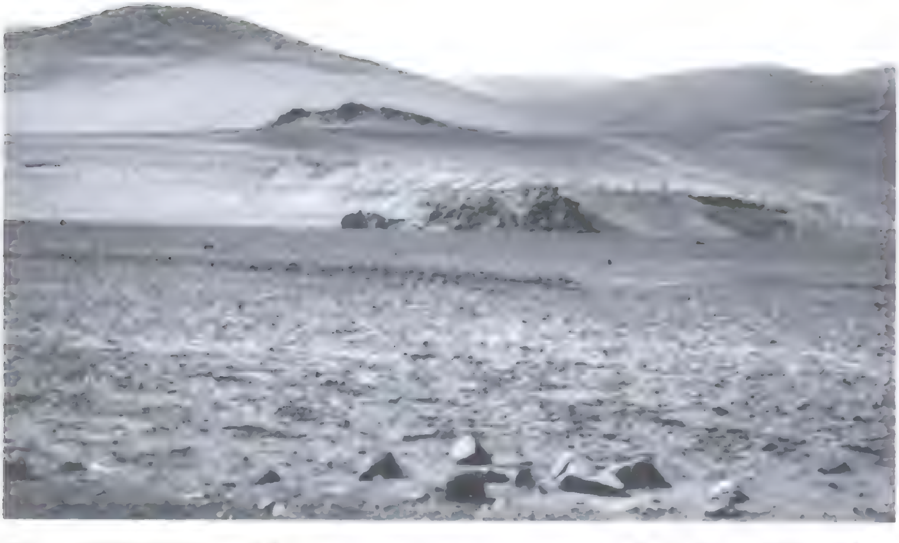


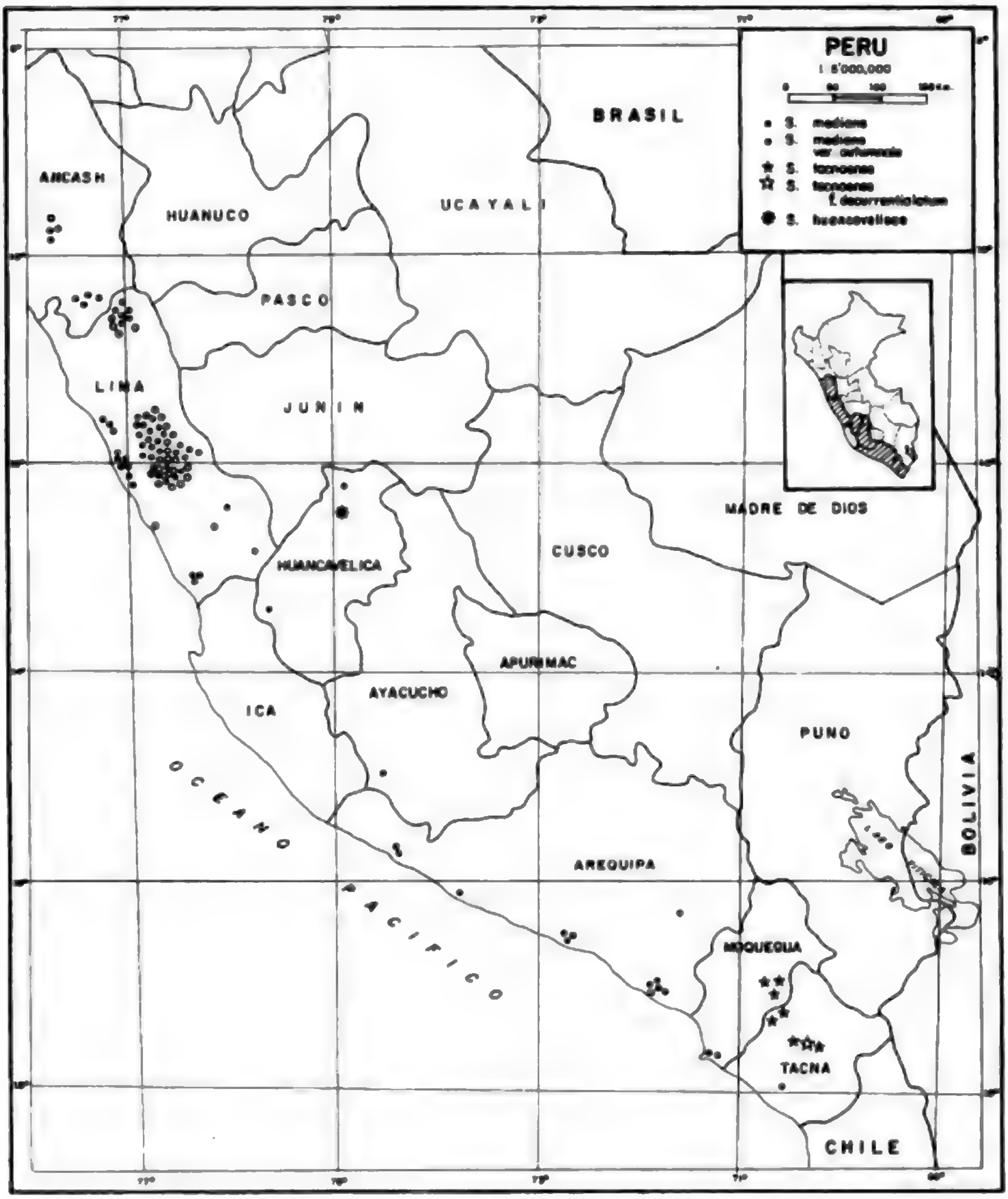
Figure 336. Habitat of *Solanum medians*-3x, Lomas de la Buitrera 350-400 m alt., Moquegua.

wittmackii of the same series and numerical endosperm balance resulted in an average of 2 seeds per berry, but only when *S. wittmackii* was used as the staminate parent.

At the EBN=2 level, while no success was attained in reciprocal crosses of triploid *S. medians* with diploid *S. cantense* of Series Piurana, partial compatibility was observed in reciprocal crosses of triploid *S. medians* with other species of Series Tuberosa. Some of these intraseries crosses resulted in very low seed set, and then only when the diploid species were used as staminate parents. Such was the case, for instance, with crosses involving triploid *S. medians* and *S. coelestispetalum*, *S. leptophyes*, *S. medians-2x*, *S. multiinterruptum* and *S. tacnaense*. However, other intraseries crosses involving triploid *S. medians* and the two diploid species, *S. bukasovii* and *S. phureja*, were surprisingly successful, but then again only when the two aforementioned species were used as the staminate parents. The very low seed set observed for crosses involving *S. amayanum* was especially disappointing, however, as this latter species represents the closest wild relative of *S. bukasovii*.

With respect to crosses involving triploid *S. medians* and cultivated diploid species, only few seeds were obtained when crosses were made with pollen from *S. goniocalyx* and *S. stenotomum*. However, as borne out by the reciprocal crosses involving *S. phureja*, higher yields might be obtainable if the cultivated species were to be used as the pistillate parents.

Lastly, unilateral crosses involving triploid *S. medians* and triploid *S.* × *chaucha* yielded an average of 7 seeds per berry, while the unilateral crosses involving the tetraploid *S. tuberosum* subsp. *andigena* and pentaploid *S.* × *curtilobum* (both EBN=4) went wanting for results.



Map 29. Distribution of *S. medians*, *S. medians* var. *autumnale*, *S. tacnaense*, *S. tacnaense* f. *decurrentialatum* and *S. huancavelicae*.

Table 84. Fertility of *Solanum medians* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	LIGNICAULIA	× *S. lignicaule*	3	1	0
24	1	PIURANA	× *S. hypacrarthrum*	20(13)	2(0)	0(0)
24	1	TUBEROSA	× *S. immite*	12	2	0
			× *S. wittmackii*	17(12)	3(1)	2(0)
24	2	PIURANA	× *S. cantense*	20(10)	9(0)	0(0)
			× *S. chiquidenum* var. *robustum*	9	6	2
24	2	TUBEROSA	× *S. amayanum*	7	5	3
			× *S. bukasovii*	29(6)	24(2)	25(48)
			× *S. coelestispetalum*	10(8)	10(0)	2(0)
			× *S. goniocalyx*	37	31	4
			× *S. leptophyes*	12(6)	10(0)	12(0)
			× *S. marinasense*	4	0	0
			× *S. medians-2x*	87(8)	61(1)	25(0)
			× *S. multiinterruptum*	27(9)	13(0)	4(0)
			× *S. orophilum*	18	17	12
			× *S. phureja*	89(13)	65(2)	5(41)
			× *S. stenotomum*	3	3	2
			× *S. tacnaense*	27(7)	17(0)	3(0)
			× *S. tapojense*	9	2	3
36	2	TUBEROSA	× *S.* × *chaucha*	5	4	7
48	4	TUBEROSA	× *S. tuberosum* subsp. *andigena*	22	20	0
60	4	TUBEROSA	× *S.* × *curtilobum*	19	19	0

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 85. Collections (OCH) used in *Solanum medians* fertility studies.

LIGNICAULIA
S. lignicaule 11316

PIURANA
S. cantense 14681, 14826
S. chiquidenum var. *robustum* 13967
S. hypacrarthrum 11692, 13272

TUBEROSA
S. amayanum 4299
S. bukasovii 13121, 13676, 14382, 14407
S. coelestispetalum 14341
S. goniocalyx 00001, 5409, 14502
S. immite 14491
S. leptophyes 13743
S. marinasense 13722
S. medians-2x 11884, 12047, 13140, 13185, 13266
S. medians-3x 11249, 11261, 11265, 11267, 11767, 11883, 11878, 13035, 13036, 13141, 13142, 13144, 13187, 13261, 14908
S. multiinterruptum 14718, 15702
S. orophilum 13323
S. phureja 13901, 15072, 15074, 15130, 15325, 15326,
S. stenotomum 1889-85
S. tacnaense 11609, 11612
S. tapojense 11821
S. tuberosum subsp *andigena* 5298
S. wittmackii 11886, 13258
S. × *chaucha* 4746
S. × *curtilobum* 10861

70a. *Solanum medians* Bitt. var. *autumnale* Corr., Wrightia 2(4):190-191, 1961. Figs. 337-347; Map 29.

S. weberbaueri Bitt. Fedde, Repert. Sp. Nov. 11:365-366, 1912. Type: PERU. Department Arequipa, Province Mollendo [Prov. Islay], Tambo, 500-600 m alt., among rocks, in *loma* formations, October 1902, *Weberbauer 1575* (B-destroyed, F-photo and fragment, GH-photo, NY-photo, US-photo, ex Herb. B).

S. medians var. *majorifrons* subvar. *protohypoleucum* Bitt. Fedde, Repert. Sp. Nov. 12:150-151, 1913. Type: PERU. Department Lima [Province Huarochirí], Tambo de Viso, *M. Martinet 232 p.p.* (P, G-photo, F-photo N° 39191).

S. medians Bitt. var. *angustifoliolum* Ochoa, in *Los Solanum tuberíferos Silvestres del Perú*, 241-246, 1962. Type: PERU. Department Lima, Province Cajatambo, San José, 2700 m alt., near Churín, 6 April 1961, *Ochoa 2352* (OCH).

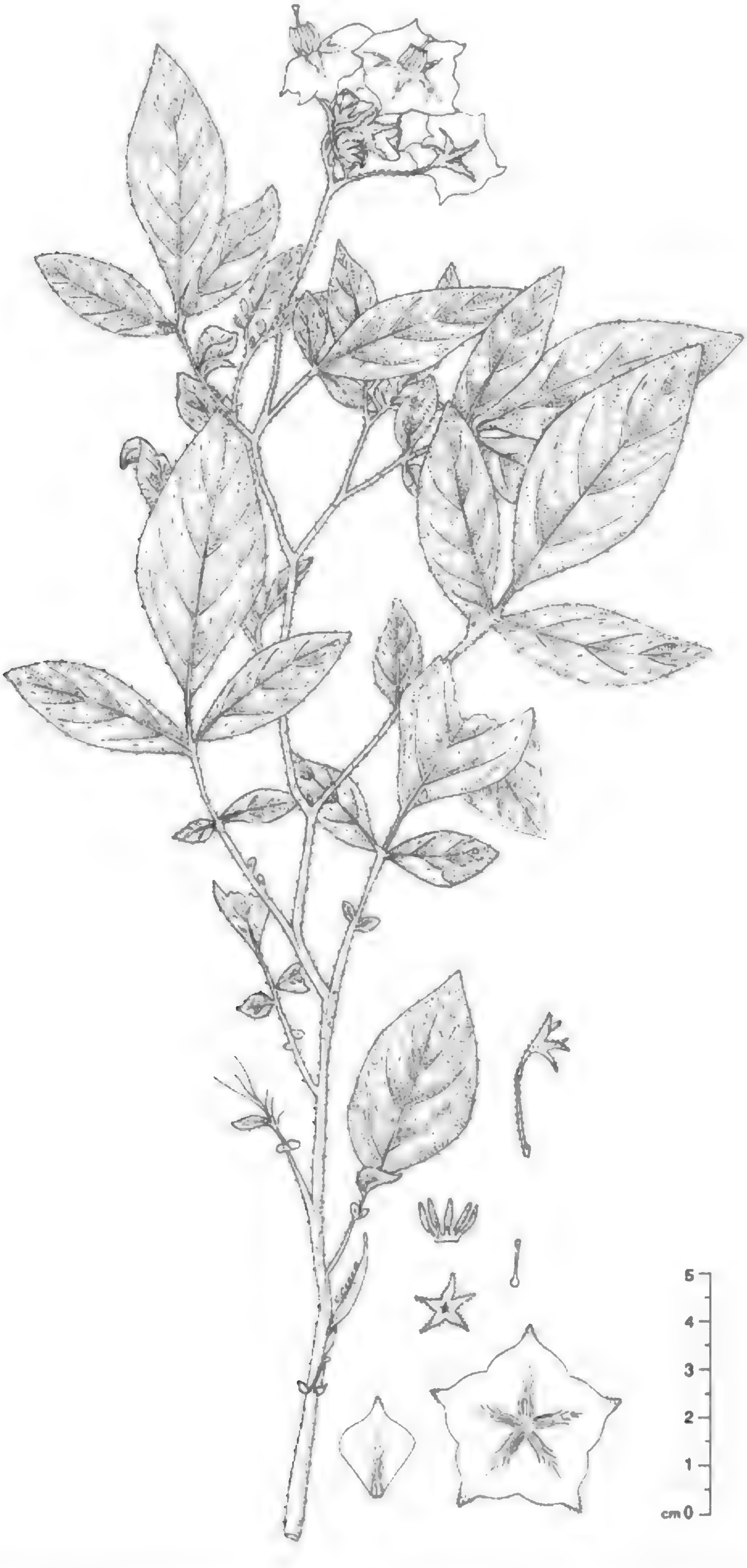


Figure 337. *Solanum medians* var. *autumnale*, 2n=24 (*Ochoa 691*).

Plant habit similar to the typical species. Stolons very long, 30-40 cm, tubers white, globose to oval-compressed or long subfalcate, the ends obtuse, 1.5-4.0 cm long. Leaves imparipinnate and densely pilose, (7.0-)9.5-19.0(-21.5) cm long by (3.5-)5.0-11.5 cm wide, with 2-3(-4) pairs of lateral leaflets and 0-2 pairs of interjected leaflets. Terminal leaflet (4-)6-10(-12) cm long by (2.0-)2.5-3.8(-5.0) cm wide. The first pair of lateral leaflets (2.4-)4.5-8.0(-10.0) cm long by (1.0-) 2.0-3.0(-4.7) cm wide, narrowly decurrent about the rachis along the basiscopic side. Inflorescence cymose-paniculate, more floriferous than the typical species, 15-25-flowered. Peduncle 5-9 cm long, bifurcate (forks 10-15 mm long), sparsely pilose; pedicels 20-30(-40) mm long, densely pilose, articulated 5-7 mm below the base of the calyx. Calyx symmetrical or asymmetrical, 7-9 mm long, pigmented very dark purple, lobes narrowly-lanceolate, long-acuminate, acumens reflexed, densely and coarsely pubescent, hairs silvery-white, shiny. Style 9.5 mm long, exerted 3.0-3.5 mm, filiform, glabrous or sparsely papillose, papillae very short and distributed in the basal one-third of its length; stigma claviform to subcapitate, cleft. Fruit globose, 1.5-2.0 cm in dia., grayish-green, flecked with white dots, not verrucose; seeds abundant. Chromosome Number: 2n=24. EBN=2.

Local Name: *Papa Zorra* or *Papa Cimarrona*, in the *lomas* of Quilmaná, Gonzalillo and Hualcará, south of Lima.

Type: PERU. Department Lima, Province Huarochirí, valle of the Rímac River, at km 70, above the Lima-La Oroya highway, east of Lima, 1850 m alt., in crevices of rock walls, 21-26 April 1942, *T. H. Goodspeed 33116* (holotype GH, isotypes F, MO, US).

Solanum medians var. *autumnale* differs from the typical *S. medians-3x* by the more narrowly-lanceolate or rhombic-lanceolate terminal leaflets that are acuminate or subacuminate at the apex and cuneate at the base (see Figs. 337 and 338). Moreover, this variety has longer pedicels and produces more numerous flowers and seeds than the typical variety, and the coloration of the stem, leaf axils, rachis and principal leaf nerves is more accentuated in deep purple than in the triploids forms of this species.

Plants of this variety with broadly elliptic leaflets similar to those of the typical variety of *S. medians* have been found only rarely in nature (see, for example, *Ochoa 7413*; 2n=24). Possibly, the broader leaflets of such individuals may be due to their growth under deep shade conditions such as found in lush thickets of herbs and shrubs or perhaps to growth in very rich moist soils.

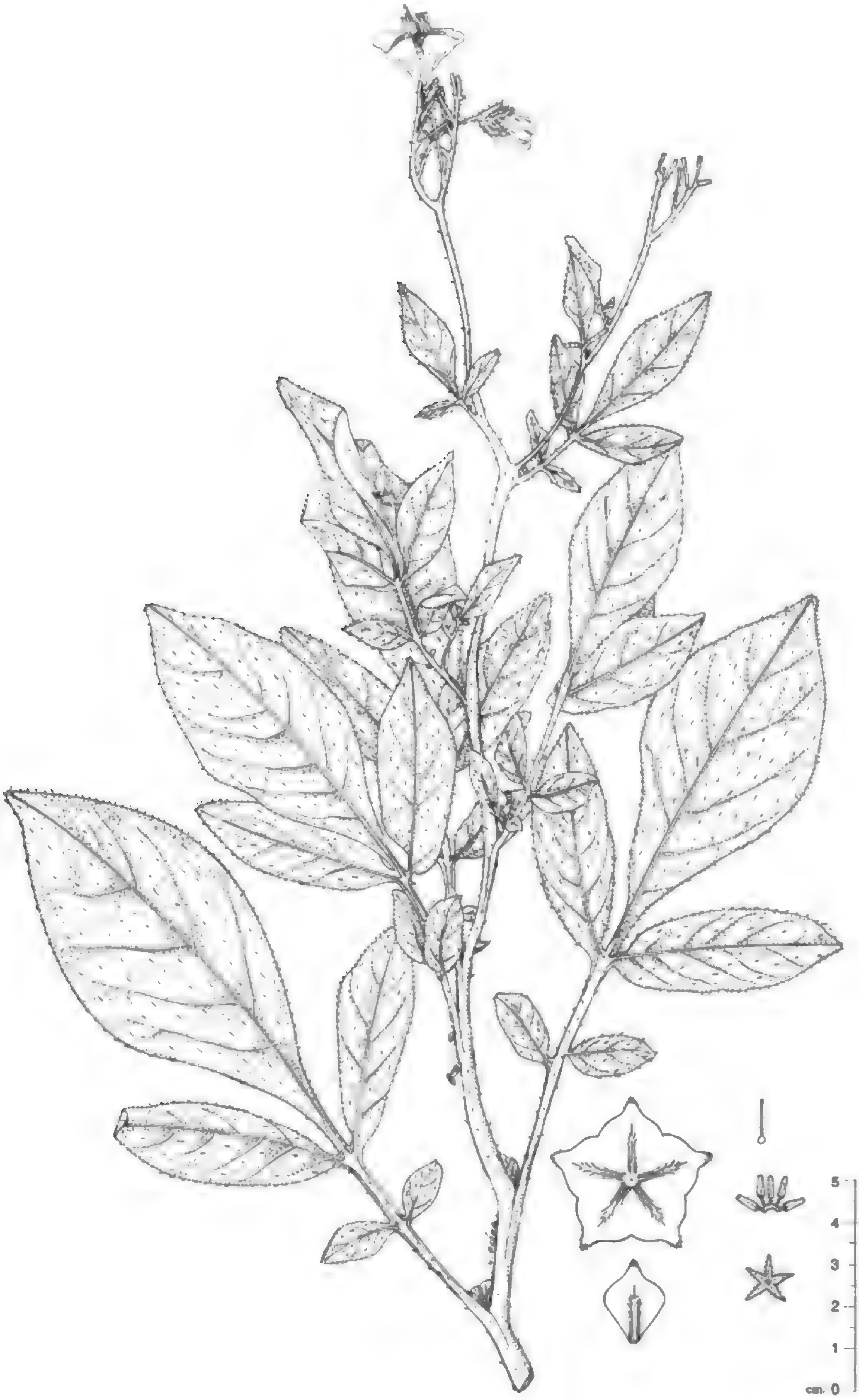


Figure 338. *Solanum medians* var. *autumnale*, 2n=24 (*Ochoa 11884*).

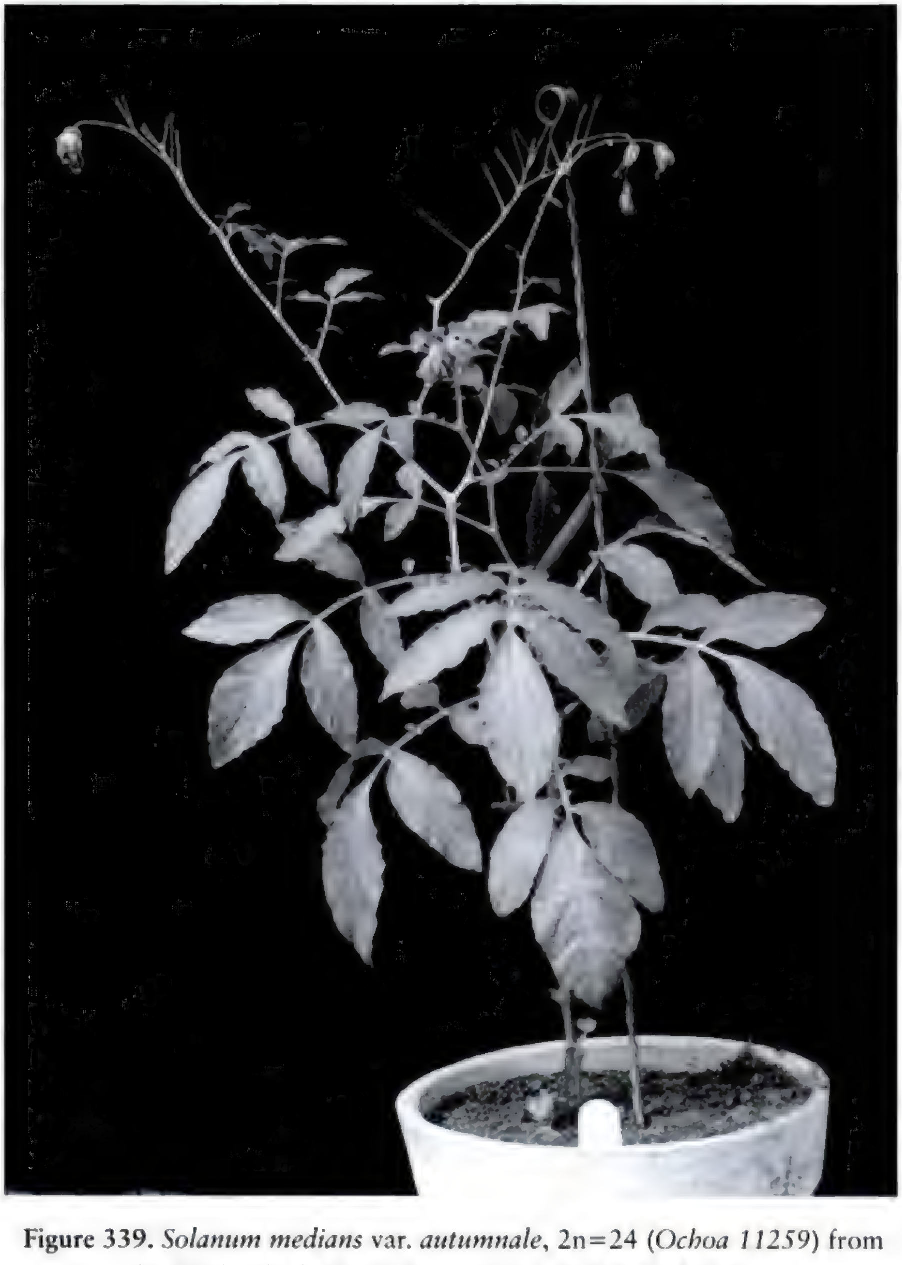


Figure 339. *Solanum medians* var. *autumnale*, 2n=24 (*Ochoa 11259*) from the Quebrada de Cachullo, south of the Lomas de Posco.

Affinities

Solanum medians var. *autumnale* is related to *S. sandemanii*. Both are similar in having very narrow leaflets and pubescent, narrowly lanceolate calyx lobes that are very long-acuminate at the apex.

Although having a number of characteristics in common with *S. sandemanii*, this variety of *S. medians* also shows linkage to *S. tacnaense*. According to Correll (1962), var. *autumnale* represents the northern extension of a montane linkage between the southern *S. tacnaense* complex and the *S. medians* complex centered in the Department of Lima. Thus, *S. medians*, which is distributed more than a thousand kilometers along the coast of Peru, constitutes a complex related to *S. tacnaense*, and one which is evolutionarily tied to it through its var. *autumnale*.

Habitat and Distribution

In the past, it was believed that all the various coastal species of wild potato, such as *S. medians*, *S. immite*, *S. mochiquense* and *S. wittmackii*, were exclusive residents of the *loma* formations. However, today, thanks to the many additional collections of wild potato species that have been added to the world's herbaria, it is known that the ranges of many coastal species extend actually considerably further up the mountain valleys than had been previously thought. In fact, as in the case of the above-cited species, some also occur in altitudinal zones between 2000 and 3000 m.

The dual occurrence of wild potato species in the *lomas* and mountains of the coast is not surprising in view of the history of migration of these plants in ancient times. Originally known only from the high mountain regions of Peru, some migrated down through the coastal valleys where they eventually became established in the fog-induced and very ephemeral *loma* formations. However, survival in the *loma* formations is greatly dependent upon adjustment to the differing climatic conditions of the coast, for the growing season in the *lomas* is the reverse of that found in the mountains. In the *lomas*, plants initiate their growth in April or May and complete their life cycles in October or November; whereas, in the high mountains, the growing season falls between December and April or May.

The habitat conditions under which this variety of *S. medians* grows are basically similar to those found for the typical species. Var. *autumnale* has been collected from sand dunes, rock piles, quebradas, mountain slopes and the crevices of rock walls. It grows preferentially in gravel or in poor sandy-clay soils at

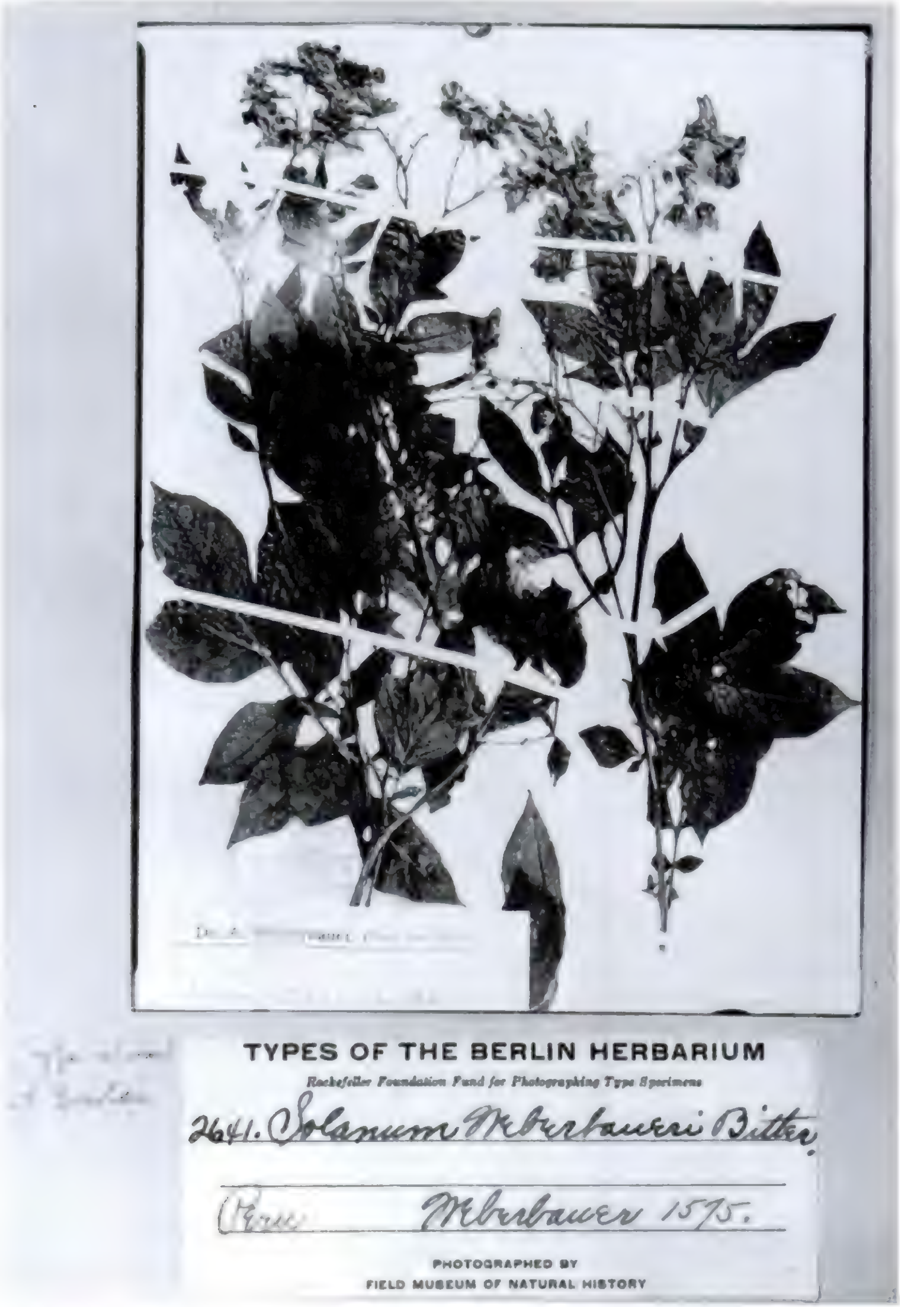

TYPES OF THE BERLIN HERBARIUM
Rockefeller Foundation Fund for Photographing Type Specimens
2641. Solanum Weberbaueri Bitter
Peru Weberbauer 1575.
PHOTOGRAPHED BY
FIELD MUSEUM OF NATURAL HISTORY

Figure 340. *Solanum medians* var. *autumnale* (*Weberbauer 1575*, type collection of *S. weberbaueri*). Photo: Courtesy of the Field Museum of Natural History (F).

elevations ranging between 150 m to 3600 m. In its high quebrada habitats, this plant grows in association with various species of cacti, Verbenaceae, *Alonsoa*, *Siphocamplilus*, *Sonchus*, *Bidens* and *Eupatorium*.

Of the approximately 109 collections of *S. medians* var. *autumnale* that were included in this study (30 of which were confirmed to have 2n=24 chromosomes), three were collected from areas lying between 200 and 500 m altitude (two from the lomas of Caracoles-Pucusana south of Lima and one from Quebrada de Cachullo, lomas of Posco, Arequipa; see Map 29); whereas, 80 came from elevations between 1850 and 3100 m, and 14 from elevations between 3200 and 3600 m.

Unfortunately, the chromosome number of Weberbauer's collection No. *1575* (which includes the type specimen of *S. weberbaueri*) was never determined, and thus can never be known for sure. Nevertheless, the leaves and leaflets of the several plants that make up this collection (Fig. 340) are appreciably narrower than those found in Weberbauer's No. *5683*, (the lectotype of *S. medians*; Fig. 327). Hence, it is presumed to be diploid. Although the author visited the type locality of *S. medians* var. *autumnale* on several occasions in the hopes of finding some living plants of this entity for cytological analysis, it no longer appears to grow there. The *lomas* of Tambo in the Department of Arequipa are no longer today what they were in the past, as the entire general area has suffered considerably from erosion.

Geographically, this variety extends from northcentral to southern Peru, in the Departments of Ancash, Lima, Arequipa and Tacna (Map 29).

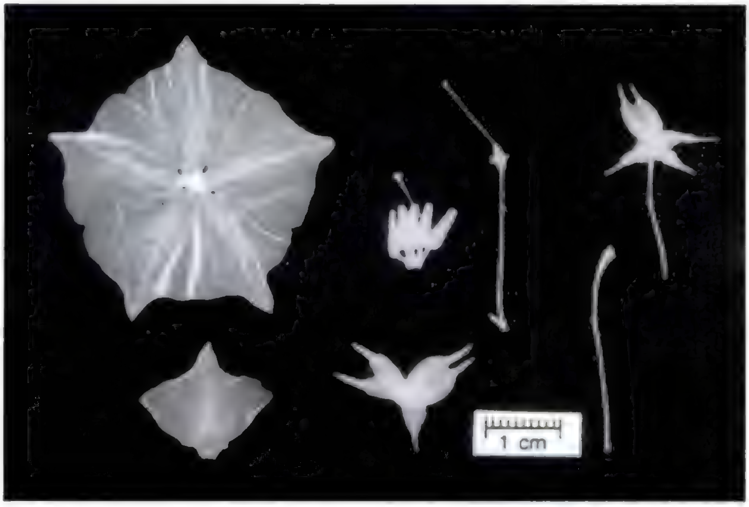


Figure 341. Floral dissection of *Solanum medians* var. *autumnale* (*Ochoa 12047*), from a specimen collected at Surco.

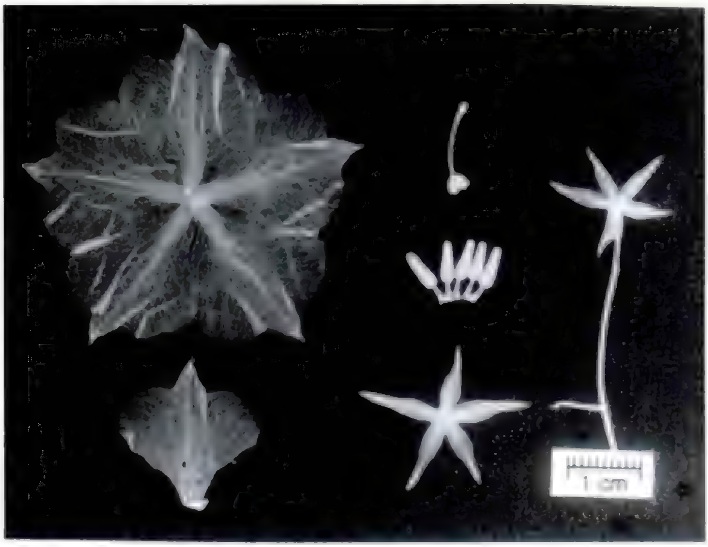


Figure 342. Floral dissection of *Solanum medians* var. *autumnale* (*Ochoa 13264*), from a specimen collected at Huinco-Seque, Santa Eulalia, Lima.

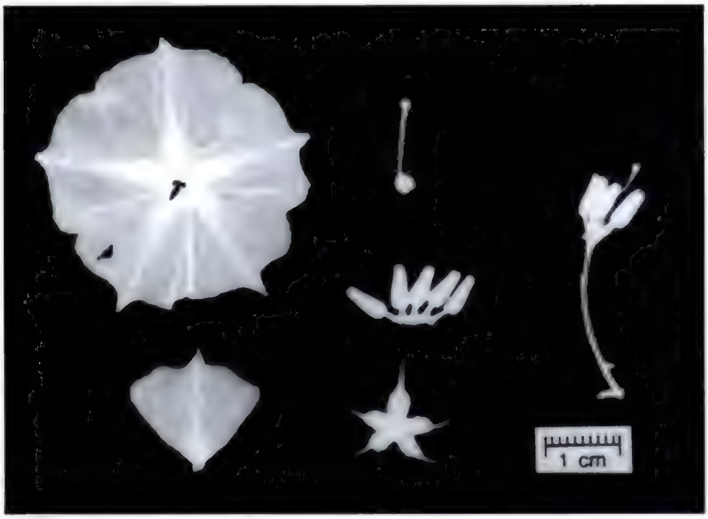


Figure 343. Floral dissection of *Solanum medians* var. *autumnale* (*Ochoa 11249*), from a specimen collected at Caracoles-Pucusana.

Specimens Examined

Department Ancash

Province Aija: Casablanca, 3100 m alt., above Huayán, on restored ground, moist, berries globose, 7 April 1970, *C. Ochoa 2722* (CIP, GH, OCH, US). Yuncapampa, 2000 m alt., between Aguada Monsalve and Ushpacoto, along the San Miguel-Huayán railroad line, April 1971, *C. Ochoa 2966* (OCH). From the top of the Cuesta del Mellizo toward Aija, 3400 m alt., along the pedestrian trail from Huayán to Aija via Succha, among plants of *Agave* sp., berries globose, 25 April 1983, *C. Ochoa 15188* 2n=24 (GH, OCH, US).

Province Bolognesi: Lower slopes of Cerro Choquitambo, 3300 m alt., near Ocros, May 1952, *C. Ochoa 2027* (OCH, plants grown in the experimental field at El Mantaro, near Huancayo, propagated from the original tubers). Timpo, 2750 m alt., near Purish, along the pedestrian trail from Chiquián to Pancal, 2 March 1962, *C. Ochoa* and *F. de la Puente 2400* (OCH). Quisapata, 2950 m alt., along the pedestrian trail from Chiquián to Purish, 14 April 1963, *C. Ochoa 2487* (OCH) and *2487A* (OCH, from plants grown at Universidad Nacional Agraria La Molina, Lima). Lower slopes of the mountain facing Timpo, 2900 m alt., heading down toward Purish, along the pedestrian trail from Chiquián to Pancal, 14 April 1963, *C. Ochoa 2488* (F, GH, MOL, OCH, US, USM). Fraguapampa, 2750 m alt., between Chichoj and Mascash, along the pedestrian trail from Chiquián to Purish and Pancal, 14 April 1963, *C. Ochoa 2491* (F, GH, MOL, NY, OCH, US).

Province Huaraz: On a gravel slide several km below Jupash, 3050 m alt., plants brittle, flowers deep lavender, rotate-pentagonal to broadly stellate, tubers large, irregularly round or elipsoid, up to 4 cm long, 28 March 1960, *D.S. Correll and E.E. Smith P949* (LL).

Department Arequipa

Province Arequipa: Rock ledges along draw above Arequipa, 2600-2700 m alt., 7-16 April 1925, *F.W. Pennell 13196 p.p.* (US).

Province Islay: Province Mollendo [Prov. Islay], Tambo, 500-600 m alt. among rocks in *loma* formation, October 1902, *A. Weberbauer 1575* (F-fragment and photo, type collection of *S. weberbaueri*). Quebrada de Cachullo, 400-500 m alt., *lomas* of Posco, entering by Cachendo to the *lomas* of Posco, growing with *Nolana sedifolia* and a non-tuberous *Solanum*, 26 October 1976, *C. Ochoa 11259*, 2n=24 (OCH, original collection; CIP, MOL, OCH, US, plants grown at La Molina, Lima, and OCH, from plants grown at Huancayo).

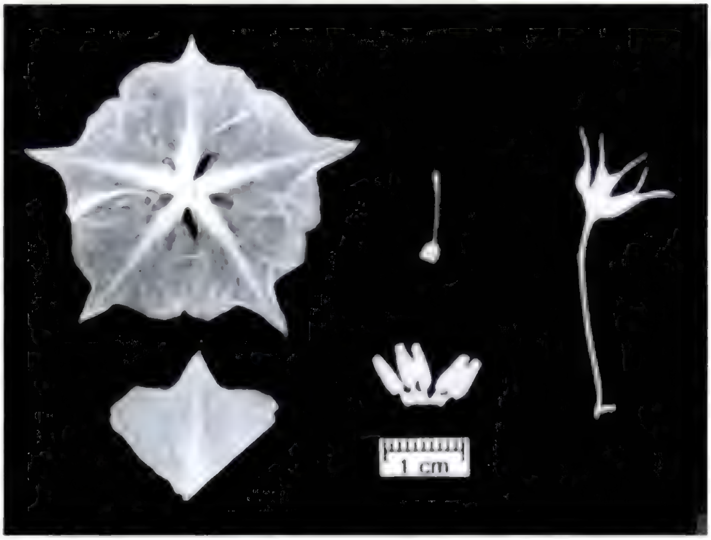


Figure 344. Floral dissection of *Solanum medians* var. *autumnale*, 2n=24 (*Ochoa 11259*) from Cachullo, Lomas de Posco, Arequipa.

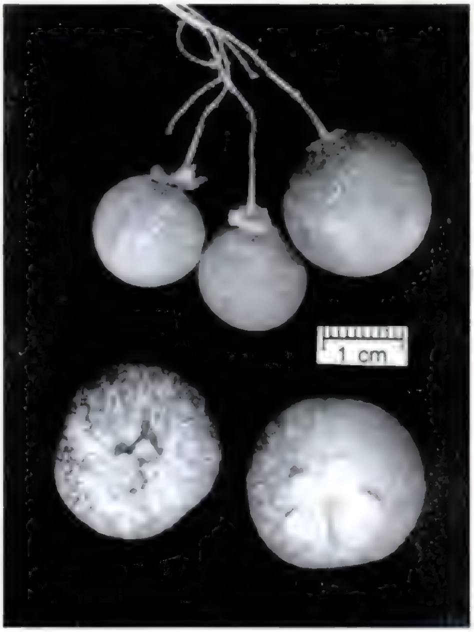


Figure 345. Fruits of *Solanum medians* var. *autumnale* (*Ochoa 12047* and *11637*).

Departmento Ayacucho

Province Lucanas: Between large stones and rocks on the western slopes of the Andes about 45 km. from Nasca along the route to Puquio, 2200 m alt., plants with small tubers but without flowers, 14 February 1958, *D.S. Correll and E.E. Smith P148* (LL).

Department Huancavelica

Province Tayacaja: Above Marcavalle, 3100 m alt., District of Huachocolpa, fruits globose, 21 April 1964, *O. Tovar 4776* (WIS).

Department Lima

Province Cajatambo: San José, near Churín, 2500 m alt., 6 April 1961, *C. Ochoa 2352* (OCH, type collection of *S. medians* var. *angustifoliolum*). Naván, 3200 m alt., April 1978, *C. Ochoa and A. Salas 12500*, 2n=24 (CIP, MOL, OCH, UNTC, USM). Tunaspata, 3280 m alt., near Churín, April 1978, *C. Ochoa and A. Salas 12573*, 2n=24 (CIP, MOL, OCH, USM). Oshacoto, 3600 m alt., 2 km northeast of Cajatambo, 31 January 1979, *C. Ochoa 13140,* 2n=24 (CIP, OCH, US). Cruz-Circa, 3400 m alt., above Utcas, on terraces between Cajatambo and Cajamarquilla, associated with *Sonchus, Bidens* and *Opuntia exaltata*, 12 April 1982, *C. Ochoa 14672* (OCH, US). Poclo, 3000 m alt., south of Acaín, above Agen, District of Pachangará, berries globose, light green, tubers 3-4 cm

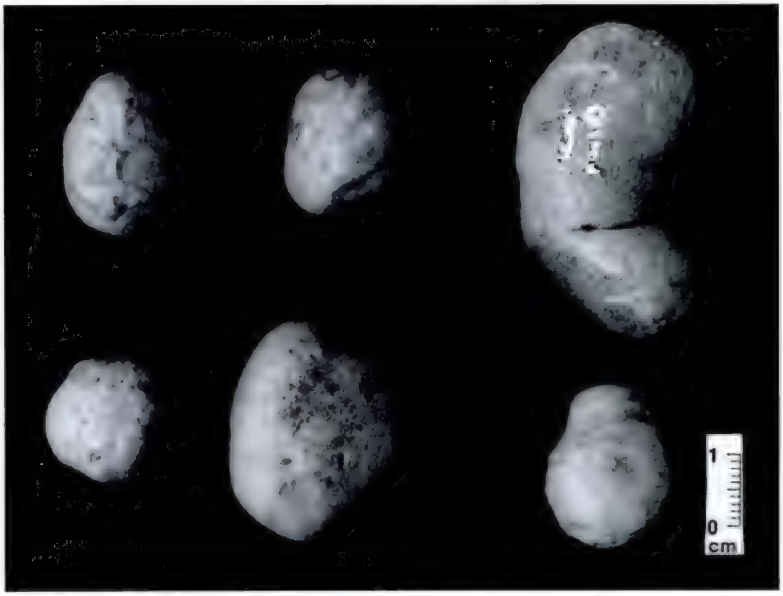


Figure 346. Tubers of *Solanum medians* var. *autumnale,* 2n=24 (*Ochoa 12047*), collected at San Pedro de Casta, Huinco, Lima.

long, whitish-yellow, 12 April 1982, *C. Ochoa 14678*, 2n=24 (CIP, F, GH, OCH, US, from plants grown in the greenhouse at Huancayo). Manco Cona, 3400 m alt., flowers purple, 12 April 1982, *C. Ochoa 14684* (CIP, OCH, US).

Province Canta: Vicinity of Canta, 2900-2950 m alt., in the stony foothills of a mountain, flowers purple, 16 March 1950, *R. Ferreyra 6915* (OCH, USM). Vicinity of Canta, 2900-2950 m alt., in the stony foothills of a mountain, flowers bluish with a white border, 16 March 1950, *R. Ferreyra 6918* (OCH, USM). Between Canta and Yangas, 2300-2400 m alt., in the stony foothills of a mountain, flowers purple, 16 March 1950, *R. Ferreyra 6932* (OCH, USM). Lower levels of Cerro San Miguel, 2600 m alt., facing Obrajillo, near Canta, plant 50 cm tall, flowers deep purple, 23 March 1951, *C. Ochoa 1138* (OCH). Cabra Marca, 2700-2800 m alt., near Canta, on lower levels of the mountain, in rocky-clay soils, plant 80 cm tall, corolla deep purple, rotate, 3-4 cm dia., calyx densely pilose, tubers oval-flattened to round, white, stolons 30-40 cm long, 24 March 1951, *C. Ochoa 1155*, 2n=24 (GH, OCH). Slope of Huamantanga, 3300 m alt., heading up from Shuyo (today Nuevo San José) toward Huamantanga, on rocky talus slopes of the road, 30 March 1953, *C. Ochoa 2048* (OCH). Canta, 2600 m alt., mountain *pluviifolio*, flowers purple, 2 April 1953, *R. Ferreyra 9000* (LL, OCH, USM). Near Canta, 2200-2700 m alt., 2 April 1953, *Peterson and Hjerting 1162=PI-210045.1*, from plants grown at Sturgeon Bay, Wis., U.S.A., 25 August 1955 (LL). Near km 80 below Canta on road to Lima, 2200 m, on rocky ledges and among boulders, plants erect, flowers purple, rotate with prominent acumens, 7 March 1958, *D.S. Correll, E.E. Smith and R. Ferreyra P282* (F, LL sheets 1-2). On ledges along river below Canta, 2475 m alt., plants robust, flowers purple, rotate, 7 March 1958, *D.S. Correll, E.E. Smith and R. Ferreyra P283* (LL). On rocky brushy slopes above Canta, 2850 m alt., flowers large, purple, rotate, 7 March 1958, *D.S. Correll, E.E. Smith and R. Ferreyra P285* (LL). Near Canta, 2700-2800 m alt., rocky foothills, flowers purple, 7 March 1958, *R. Ferreyra 12948* (LL, USM). Huamanmayo, 2600 m alt., near Canta, 2 April 1960, *C. Ochoa 2287* (OCH). 23 km before Canta, among stones, without flowers, 23 March 1971, *M. Quijandría and H. Ross 71-115* (CIP, OCH). 6 km before Canta, *M. Quijandría and H. Ross 71-117* (CIP, OCH). 1 km before Canta, 2800 m alt., 22 March 1971, *M. Quijandría and H. Ross 71-118* (CIP, OCH). Carhua, 2700 m alt., (8 km above the bridge to San José), roadside, in rocky-sandy soil, flowers blue, n.v. *Papa de Abuelo*, 15 March 1974, *G. Vilcapoma 199-1* (CIP, OCH), *199-2* (CIP, MOL, OCH). San Buenaventura, 2800 m alt., (right bank of the Chillón River) on a rocky-clay hillside dominated by herbaceous vegetation, flowers blue (purple), 15 March 1974, *G. Vilcapoma 200-1, 200-2, 200-3* (CIP, OCH) and *200-4* (CIP). Carhua, 2800 m alt., (Chiringano), in sandy-stony soil near the bank of the river and edge of the road, flowers purple, n.v. *Papa de Abuelo*, 15

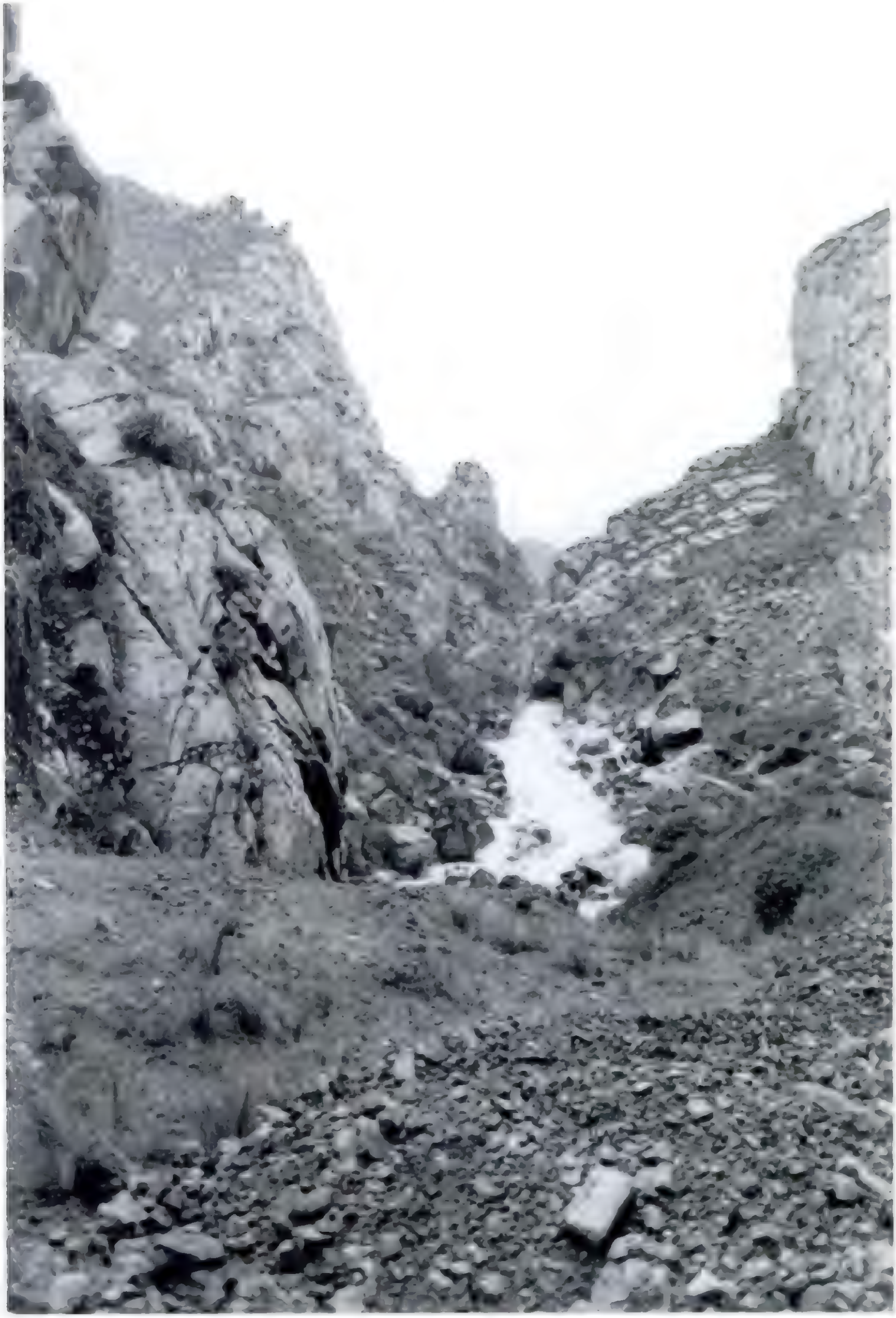


Figure 347. Habitat of *Solanum medians* var. *autumnale*, Cañón del Rímac, 3000 m alt., between Tambo de Viso and San Mateo, along the Lima-La Oroya road.

March 1974, *G. Vilcapoma 201* (CIP, OCH), *204 and 205* (CIP). San Buenaventura, 2800-2850 m alt., in sandy-clay foothills, dominated by shrubby vegetation, plants scattered, flowers purple, 15 March 1974, *G. Vilcapoma 202-1* and *202-2* (CIP, OCH). Carhua, 2800 m alt., between Chiringano and Tambo, in rocky ground, toward the bank of the river and on the edge of the road, flowers purple, without date, *G. Vilcapoma 203* (CIP, OCH). Pariamarca, 2850 m alt., [near Canta] on clay hillsides dominated by herbaceous and shrubby vegetation, flowers violet, 15 April 1974, *G. Vilcapoma 206* (CIP, OCH). San Miguel, 2800-2950 m alt., [near Canta], in rocky foothills near cultivated land or in very moist mountain forests, n.v. *Papa de Abuelo*, flowers purple, 12 April 1974, *G. Vilcapoma 211-1, 211-3, 211-5, 211-6, 211-8* (CIP), *211-2* (CIP), *211-7* (CIP, OCH), *212-1* and *212-2* (CIP). Vicinity of Canta, 3000 m alt., highway toward Pariamarca, in sandy-clay or rocky land, flowers purple, 13 April 1974, *G. Vilcapoma 214-1* (CIP, OCH) and *214-2* (OCH). Canta, 3100 m alt., along the route to Pariamarca, March [April?] 1974, *G. Vilcapoma 218* (CIP, MOL, OCH), *218-2, 218-3 and 218-4* (OCH). Chuquitama, 2700 m alt., vicinity of Obrajillo, near Canta, 10 March 1977, *C. Ochoa 11302* (CIP, F, GH, MOL, NY, OCH, US). At km 89 of the Lima-Canta road, 2350 m alt., on rocky xerophytic hillsides, near columnar and globose cacti, associated with *Bidens*, various grasses and herbs, near another tuberous *Solanum* with white flowers, 8 April 1983, *C. Ochoa 15148*, 2n=24 (CIP, F, OCH, US).

Province Cañete: *Lomas* of Quilmana, 350 m alt., about 15 km north of Cañete, growing near *S.* × *neoweberbaueri*, 25 October 1976, *C. Ochoa* and *A. Salas 11253*, 2n=24 (CIP, OCH, US, from plants grown in the experimental field at Huancayo).

Province Chancay: Naupay, 2400 m alt., among trees, flowers violet, 22 March 1975, *E. Cerrate, Chanco* and *G. Vilcapoma 257* (USM).

Province Huarochirí: San Mateo, wild potato, 1832-1854, *John McLean s.n.* (GH). Matucana, ca. 8000 feet, in thicket among large rocks, petals dark blue, April 12-May 3, 1922, *MacBride* and *Featherstone 193* (F). Viso, 2800 m alt., humus with much sand, base of cliff, annual herb 0.3 m, no tubers found but roots were very far reaching among rocks, 23 April 1939, *T.H. Goodspeed, H.E. Stork and O.B. Horton 11525* (GH). Valley of río Rímac, 1850 m alt., km 70 near Lima-La Oroya highway, east of Lima, above highway in moist crevices of rock walls, plant prostrate, 21-26 April 1942, *T.H. Goodspeed 33116* (G, GH, MO, US, type specimen of *S. medians* var. *autumnale*). Surco, 2030 m alt., February 1948, *J. Soukup 3712* (F). At km 76 of the central road, near Matucana, 2200 m alt., in foothills of a mountain, in thickets of *Lantana* sp., *non-tuberous Solanums* and cacti, in sandy-clay land, corolla light-blue, 9 March 1949, *C. Ochoa 691* (GH, OCH). Near Matucana, 2400-2500 m alt., between Chosica and San Mateo in foothills of a stony mountain, flowers purple, 2 April 1950, *R. Ferreyra 7056* (OCH, USM). El Infiernillo, canyon of the Rimac River, Lima-La Oroya highway, among large stones, scarce, very near the type collection of *S. medians* var. *autumnale*, 12 May 1953, *C. Ochoa 2053* (OCH). Huinco, 3000 m alt., [quebrada of the Santa Eulalia River, heading up by Chosica], 29 February 1972, *Z. Huamán 291* (CIP, OCH) and *292* (CIP, GH, MOL, OCH). Between Huinco and Agropica, 2700 m alt., [Quebrada of Santa Eulalia, heading up by Chosica], 3 April 1973, *Z. Huamán 357* (CIP). Autisia, *ca*. 3500 m alt., Casta, 2 km further up valley, km 25 Santa Eulalia Valley, wild potato growing in stony scree, alongside cactus, large population at side of road, 7 March, *H. Kang* and *M. Jackson 1* (CIP, OCH). Heading up from Chosica by the Quebrada de Santa Eulalia toward Huinco, 2200 m alt., on hillsides of a stony mountain, among large rocks, March 1975, *C. Ochoa 7406*, 2n=24 (CIP, GH, OCH). Heading up the pedestrian trail from San Bartolomé to the Zárate forest, 2200-2500 m alt., in lush herbaceous and shrubby vegetation, March 1975, *C. Ochoa 7411*, 2n=24 (CIP, MOL, F, OCH, US), *7413*, 2n=24 (CIP, OCH, US), and *7416* (OCH). Gigantón, 2900 m alt., near Zárate forest, going up from San Bartolomé, on the slopes of a mountain with herbaceous vegetation, 16 March 1977, *C. Ochoa 11311*, 2n=24 (CIP, MOL, OCH, US). San Pedro de Casta, 3180 m alt., 4 km east-northeast of Huinco, entering by the Quebrada de Santa Eulalia, dominated by thickets of shrubs and herbs, in rocky land, berries globose, light green, May 1977, *C. Ochoa 11637*, 2n=24 (CIP, OCH, US, from plants propagated in the greenhouse at Huancayo), and *11638*, 2n=24 (OCH, from plants propagated in the greenhouse at Huancayo). Vicinity of the Sheque dam, 3000-3100 m alt., heading up by the Quebrada de Santa Eulalia toward Huinco, on rocky hillsides, 21 February 1975, *C. Ochoa 11882*, 2n=24 (OCH, USM, US), and *11884*, 2n=24 (CIP, MOL, OCH, US, USM). Vicinity of Surco, between 2240 and 2280 m alt., in thickets of shrubs and herbs, berries globose, light green with small scattered white dots, not verrucose, sparse, 10 April 1978, *C. Ochoa 12044*, 2n=24, *12046*, 2n=24 (ambas en OCH), and *12047*, 2n=24 (CIP, MOL, OCH). Cocha, 3000 m alt., between Sheque and Huinco, heading up from Chosica by the Quebrada de Santa Eulalia, on rocky hillsides, poor vegetation, 16 February 1979, *C. Ochoa 13185*, 2n=24 (CIP, GH, OCH, US). Lower levels of Cerro Churguruma, 2740 m alt., nearly 1 hour by foot west of Matucana, plants 50 cm tall, corolla purple, berries abundant, in herbaceous vegetation with small shrubs of *Salpichroa* sp., March 1979, *C. Ochoa and S. Keel 13243*, 2n=24 (CIP, OCH, US). Between Huinco and Seque in the Unilateralion of Milloc, 1950 m alt., heading up to Huinco by the Quebrada de Santa Eulalia, abundant, berries globose, 11 April 1979, *C. Ochoa 13264*, 2n=24 (CIP, GH, OCH, US). Vicinity of Autisha, between 2325 and 2700 m alt., heading up by the Quebrada de Santa Eulalia toward Seque and Huinco, abundant colonies in full flower and fruit, berries globose 1-2 cm in dia., 11 April 1979, C. *Ochoa 13266*, 2n=24 (CIP, F, GH, OCH, US), *13268*, 2n=24 (CIP, F, GH, MOL, OCH, US, USM), and *13270*, 2n=24 (CIP, MOL, OCH, US). Monte Zárate, 3000 m alt., toward the north of Lucmani, heading up by foot from San Bartolomé, District Santiago de Tuna, on rocky hillsides, 17 March 1983, C. *Ochoa and A. Salas 15099*, 2n=24, and *15100* (CIP, OCH). At km 82 of the central road, Lima-La Oroya, 2600 m alt., between Matucana and San Mateo, berries globose 2 cm in dia., light green with small scattered white dots, 3 May 1983, C. *Ochoa* and *A. Salas 15205*, 2n=24 (CIP, OCH, US). Zárate forest, 3300 m alt., near San Bartolomé, without date, *M. Quijandría and H. Ross 71-120* (CIP, OCH) and *71-121* (CIP). Tambo de Viso, without date, *M. Martinet 232 p.p.* (P, type collection of *S. medians* var. *majorifrons* subvar. *protohypoleucum* Bitt.).

Province Lima: Sandy-rocky talus slopes at km 55 of the southern Panamerican Highway, near the *lomas* of Caracoles and Pucusana, 250 m alt., 21 October 1976, C. *Ochoa 11249*, 2n=24 (CIP, OCH).

Province Yauyos: Pilas, 3000 m alt., east of the District of San Pedro de Pilas, only floral dissection and tubers collected, 5-7 April 1982, C. *Ochoa and A. Salas 14660* (OCH).

Department Tacna

Province Tacna: *Morro* or hill of Sama, 450-500 m alt., tuber-bearing, frequent on the higher parts, among rocks, flowers bluish-purple, anthers yellow, 12 August 1957, O. *Velarde 6187* (MOL, OCH).

Breeding Potential

The results of crosses of *S. medians-2x* (2n=24) with other diploid species of EBN=1 or EBN=2 and triploids (2n=36) are given in Table 86, while the materials used in these experiments are shown in Table 87.

Much greater success was had in crosses of diploid *S. medians* with other wild diploid potato species than in crosses involving the triploid forms of this species. Triploids, as noted earlier, tend to be extremely sterile, producing few if any viable eggs and pollen.

With respect to diploid crosses involving plants having an EBN value of 1, a fair amount of compatibility was observed in reciprocal crosses of this species with various accessions of *S. dolichocremastrum* of Series Megistacroloba and *S. hypacrarthrum* of Series Piurana. The three species that were crossed, in this case, are morphologically rather similar. However, it may be of some interest to note that success in crossing was attained even in cases where some very unrelated species of Series Tuberosa were involved as, for example, in crosses employing *S. chancayense*, *S. mochiquense* and *S. wittmackii*.

At the EBN=2 level, on the other hand, the reciprocal crosses of *S. medians-2x* with other diploids gave mixed results that were quite independent of series. Relatively high averages of fertile seeds were obtained in crosses involving the species *S. cantense* of Series Piurana and *S. jalcae* of Series Ingaefolia. However, in crosses involving plants of the Series Megistacroloba, one species, *S. sogarandinum*, gave the highest average level of seed production for all species included in this study, while the remaining two species of this series, *S. megistacrolobum* and *S. raphanifolium*, gave much lower amounts. Similarly, great discrepancies in yield were obtained with respect to the various diploid species of Series Tuberosa. Notable in this regard was the fact that no seeds at all were obtained in crosses involving *S. coelestispetalum* and *S. sparsipilum*; whereas, large numbers of seeds were obtained in crosses involving both *S. tacnaense* and *S. huancabambense*. The latter species, however, is closely related to *S. medians*, while the former has little or no affinity.

Lastly, with respect to triploid plants, no seeds at all were obtained in reciprocal crosses involving *S. maglia* (2n=36), although partial fertility was observed in crosses involving *S. medians-3x*, but only when the latter species was used as the pistillate parent.

Table 86. Fertility of *Solanum medians* var. *autumnale* (2x) when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	MEGISTACROLOBA	× *S. dolichocremastrum*	11(10)	5(4)	24(27)
24	1	PIURANA	× *S. hypacrarthrum*	10(54)	3(18)	10(6)
24	1	TUBEROSA	× *S. chancayense*	10(29)	2(14)	38(2)
			× *S. immite*	23(4)	11(2)	13(0)
			× *S. mochiquense*	14(63)	4(51)	35(8)
			× *S. wittmackii*	46(32)	17(3)	35(25)
24	2	CONICIBACCATA	× *S. chomatophilum*	10(30)	8(27)	11(42)
24	2	INGAEFOLIA	× *S. jalcae*	11(12)	5(12)	20(60)
24	2	MEGISTACROLOBA	× *S. megistacrolobum*	8(3)	8(3)	22(17)
			× *S. raphanifolium*	31(15)	23(0)	28(0)
			× *S. sogarandinum*	22(13)	14(9)	10(182)
24	2	PIURANA	× *S. cantense*	30(19)	6(1)	35(66)

24	2	TUBEROSA	× *S. bukasovii*	43(33)	39(24)	5(37)
			× *S. coelestispetalum*	2(8)	1(0)	0(0)
			× *S. goniocalyx*	30(9)	20(6)	93(42)
			× *S. huancabambense*	4(14)	4(10)	175(55)
			× *S. huarochiriense*	14(3)	3(3)	78(0)
			× *S. multiinterruptum*	47(22)	35(14)	28(130)
			× *S. sparsipilum*	5	5	0
			× *S. tacnaense*	4(8)	1(2)	130(50)
36	-	MAGLIA	× *S. maglia*-3x	7(138)	3(90)	0(0)
36	-	TUBEROSA	× *S. medians*-3x	8(87)	1(61)	0(25)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 87. Collections (OCH) used in *Solanum medians* var. *autumnale* (2x) fertility studies.

CONICIBACCATA
S. chomatophilum 13208

INGAEFOLIA
S. jalcae 13344

MAGLIA
S. maglia-3x 13064, 13066

MEGISTACROLOBA
S. dolichocremastrum 12071
S. megistacrolobum 14272
S. raphanifolium 13563, 13577, 13625, 13626, 13721, 13733
S. sogarandinum 12006, 13324

PIURANA
S. cantense 14681, 14692, 14828
S. hypacrarthrum 11308, 11692, 13272

TUBEROSA
S. bukasovii 7820, 13195, 13559, 13582, 13715, 13814A, 14407, 15202, 15313
S. chancayense 11250, 11765
S. coelestispetalum 13801, 14341
S. goniocalyx 00001, 14502
S. huancabambense 11619
S. huarochiriense 11331, 14525
S. immite 11689, 13346, 14491
S. medians-3x 11261, 11878, 11883, 13005, 13035, 13144, 13187
S. medians-2x 11259, 11302, 11311, 11638, 11657, 11882, 11884, 12044, 12046, 12047, 13140, 13185, 13243, 13264, 13266, 13268, 13270, BULK *medians*
S. mochiquense 14820, 14870, 15995
S. multiinterruptum 11693, 11879, 11880, 11885, 12057a, 12066, 14718
S. sparsipilum 13517
S. tacnaense 11609
S. wittmackii 10982, 11029, 11310, 11639, 11877, 13184, 13258

71. *Solanum mochiquense* Ochoa, Agronomía, Lima, 26(2):111-112, 1959, Illustr. Figs. 348-354; Map 26; Plate XXXIII.

S. earl-smithii Corr. Wrightia 2:135-137, Fig. 25, 1961. Type: PERU. Department Cajamarca, 58 km from Cajamarca, between Chilete and the mountain pass, 1650 m alt., 24 March 1960, *D.S. Correll and E.E. Smith P836* (K, LL, S, US).

Plant erect ascending or slightly decumbent, (30-)50-70(-90) cm tall, robust, branched, stoloniferous and tuber-bearing; stem vigorous, simple or branched, (3-)7-12 mm in dia. at base, puberulent, more or less flexible, narrowly straight winged or slightly sinuous; tubers whitish-yellow, round to ovoid, 2.5-5.0 cm long. Leaves imparipinnate, (6.5-12.0-)15.0-22.0(-25.0) cm long by (5.5-9.5-)13.0-17.0(-19.0) cm wide, with 3-4(-5) pairs of leaflets and (3-)4-8(-12) pairs of interjected leaflets, soft green above, subvernicose and puberulent only on the veins and rachis, lighter green below and more puberulent, but principally on the veins and veinlets. Leaflets broadly elliptic to elliptic-lanceolate, with obtuse or pointed apex and very obliquely rounded base, sessile or shortly petiolulate. Terminal leaflet more or less similar in appearance to the laterals, (3.5-)8.0-9.0(-10.5) cm long by (1.5-)4.0-5.5(-6.5) cm wide; Pseudostipular leaves broadly sublunate, 15-20 mm long by 8-10 mm wide. Inflorescence terminal or lateral, cymose or cymose-paniculate, 10-20(-30)-flowered; peduncles usually short, 2.5-4.0(-8.0) cm long, puberulent, forked above; pedicels slender, (1-)2-3(-4) cm long, articulated near the center or slightly below the midpoint, subglabrous. Calyx 5-6 mm long, symmetric or asymmetric, subglabrous, lobes subcuadrate to ovate, with an apiculate or shortly and finely acuminate apex. Corolla rotate, white, (2.5-)3.0-3.5 cm in dia. Anther column cylindric-conical, anthers narrowly lanceolate, 6.5-7.0 mm long by 1.6 mm wide at the cordate base. Style about 10 mm long, very slender, densely papillose along the basal two-thirds of its length; stigma capitate, cleft. Fruit subcapitate to ovoid, light green, with scattered white dots, not verrucose. Chromosome Number: 2n=24. EBN=l.

Local Name: *Papita de Lomas* or *Papita Silvestre*.

Type: PERU. Department La Libertad, Province Trujillo, Cerro Campana, *lomas* near Trujillo, 400 m alt., 10 September 1952, *C. Ochoa 1822* (holotype OCH, isotypes MO, MOL, USM).

Solanum mochiquense is potentially valuable as a source of genes for the improvement of the cultivated potato. Because this species has low levels of foliate glyco-alkaloids, it is unusually resistant to heat and to certain viruses, such as

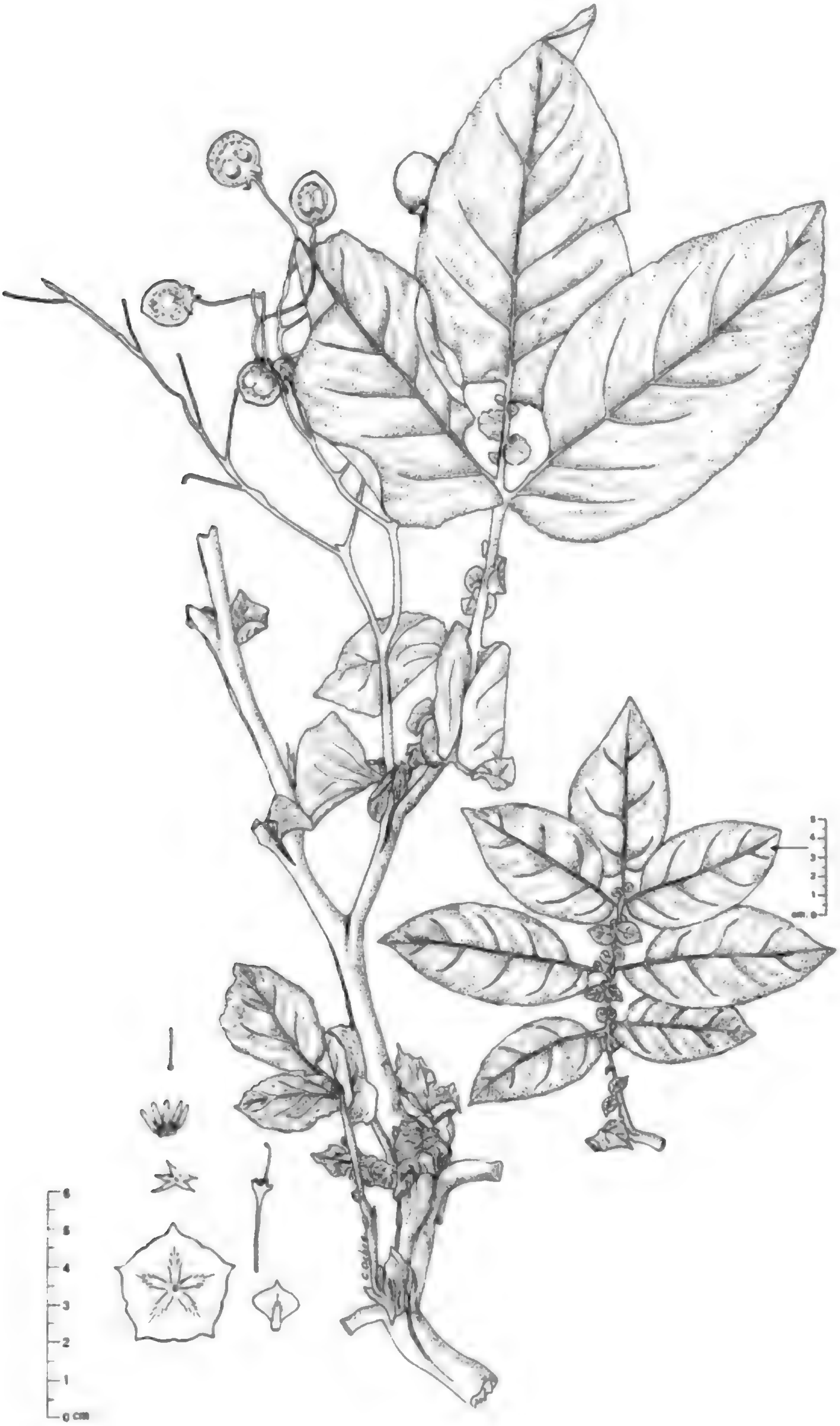


Figure 348. *Solanum mochiquense* Ochoa (*Ochoa 10724*).

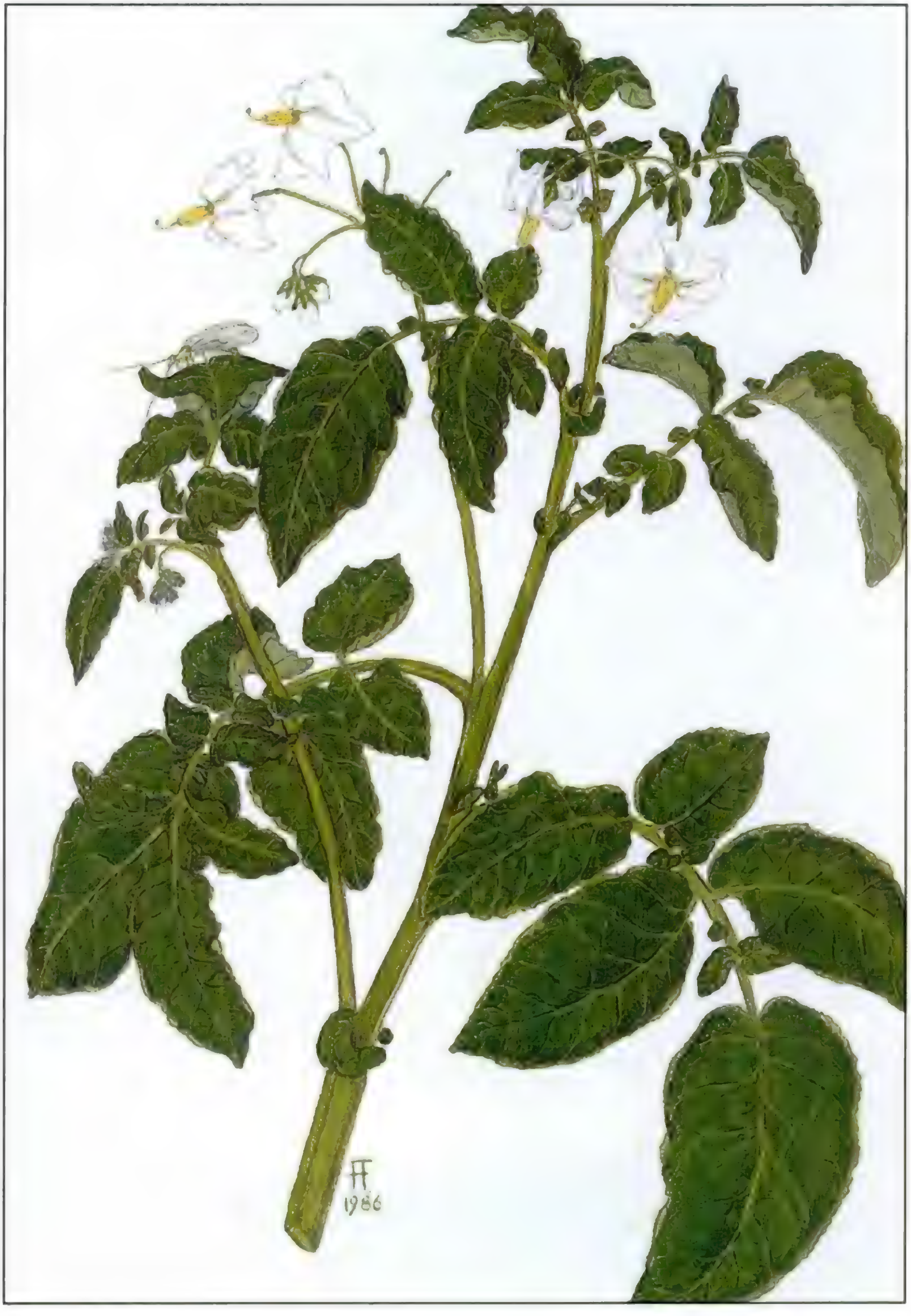


Plate XXXIII. *Solanum mochiquense* Ochoa.

PVS and PVM (Nos. *EBS-2674, EBS-2807* and *OCH S-60*). Various introductions of this species are also resistant to *Verticillium* wilt (*OCH-1822* and *OCH-11250*), potato wart or *Synchytrium endobioticum*, the potato leafhopper or *Empoasca* sp., the potato flea beatle or *Epitrix* sp, the tarnish plant bug or *Ligus linearis*, and the northern root knot nematode. Similarly, this species resists attacks of such noxious bacteria as *Erwinia carotovora*, which is the cause of the potato black leg disease, and *Corynebacterium sepedonicum*, which produces potato ring rot.

Affinities

Solanum mochiquense forms a trilogy of related species with *S. incahuasinum* and *S. chancayense* (for more on its relationships see the discussions given under the above species).

Habitat and Distribution

This species is found under a wide range of climatic and habitat conditions. First, *S. mochiquense* occurs at elevations between 350 and 550 m in the loose, sandy soils of the *loma* formations that are found along northern Peru's subtropical desert coast. Examples of such *loma* formations are found near Trujillo, where they occur in the vicinities of Cerros Chiputur, Campana and Cabras. Secondly, this species is found in the columnar cactus and acacia dominated vegetation of the western slopes and lower coastal mountain ranges of northern Peru, where it grows at elevations between 2400 and 2600 m. Two regions where this species is particularly well represented in these desert plant formations are Pencal (near Magdalena) and Cascas-Contumazá, both located in the general vicinity of Cajamarca. And, thirdly, it occurs at the northern terminus of its range in the very moist shrub forests of Cerro Mishihuaca (*ca*. 2800 m alt.), which is located near Canchaque in the Department of Piura.

Specimens Examined

Department Ancash

Province Santa: Near Ancos, 1850 m alt., between Quirós and Ancos, in foothills of a rocky mountain and in dry soil, plant senescent, only tubers were collected, 28 May 1963, *C. Ochoa 2525*, 2n=24 (OCH, from plants propagated at Escuela Nacional de Agricultura La Molina, Lima).

Department Cajamarca

Province Cajamarca: Hueco Grande, 3000 m alt., above Magdalena, near

El Mirador and Guayabo, April 1976, *C. Ochoa 10723,* 2n=24 (CIP, MOL, OCH). Pencal, 2600 m alt., above Magdalena, among *Opuntia tuna* and other columnar cacti, flowers white, April 1976, *C. Ochoa 10724* (MO, MOL, OCH, US).

Province Contumazá: Above Lledén, 2500-3000 m alt., at the base of rocks, flowers white, n.v. *Papa de Zorro*, 28 June 1983, *A. Sagástegui, J. Mostacero et al. 10799* (HUT, OCH). Near Chorrillo and La Ramada, before the tunnel of the Cascas-Contumazá road, 2600 m alt., on rocky slopes, plant vigorous, flowers white inside and white with violet stripes on the outside, May 1982, *C. Ochoa 14755*, 2n=24 (MOL, OCH). Quebrada near San Benito, 1300 m alt., on the left bank of the San Benito River, March 1987, *C. Ochoa and A. Salas 15995* (OCH).

Province San Pablo: In disturbed soil along road, 58 km from Cajamarca, between Chilete and mountain pass, 1650 m alt., leaves deep green and shiny above, flowers white, rotate-pentagonal, 24 March 1960, *D.S. Correll* and *E.E. Smith P836* (K, LL-2 sheet, S, US type collection of *S. earl-smithii*).

Department La Libertad

Province Trujillo: Cerro Chiputur, 400 m alt., facing Salaverry, in a rocky area and sandy soil, flowers white, n.v. *Papita Silvestre*, *loma* plant, 20 August 1949, *A. López 0167* (HUT, OCH). Cerro Cabras, 300 m alt., near Trujillo, 6 August 1949, *N. Angulo 1213* (HUT). Cerro Cabras, 300 m alt., Trujillo, 14 August 1949, *N. Angulo 1015* (HUT). Cerro Campana, 400-500 m alt., near Trujillo, km 565 of the northern road, in rocky *lomas*, flowers white, 18 August 1952, *R. Ferreyra 8609* (LL, OCH, USM). Cerro Chiputur, 250 m alt., 11 September 1952, *C. Ochoa 1833* (OCH). Cerro Cabras, 350 m, near Trujillo, 21 August 1956, *A. López 1210* (US). Cerro Cabras, Trujillo, 21 August 1956, *A. López and A. Sagástegui 2116* (HUT). Cerro La Pileta, 400 m alt., *lomas* of Virú, east of Guañape, in rocky-sandy soil, flowers white, 9 September 1952, *C. Ochoa 1811* (OCH). Cerro Campana, 450 m alt., in the *loma* formations near Trujillo, among rocks and in sandy-rocky soil, flowers and tubers white, 10 September 1952, *C. Ochoa 1822* (OCH holotype, isotypes MO, MOL, USM). Cerro Chiputur, 325 m alt., *loma* formations near the port of Salaverry, among rocks, 11 September 1952, *C. Ochoa 1832 and 1834* (OCH). Cerro Campana, 600-700 m alt., herb with white flowers on rocky hillsides, 30 August 1961, *A. López, A. Sagástegui e I. Sánchez 3643* (HUT, OCH, topotypes of *S. mochiquense*). Cerro Campana, near Trujillo, ca. 760 m alt., sandy, occurring in scattered patches amidst outcrops of metamorphic crystalline rocks, *loma* community, tuberous herb, up to 0.5 m tall, 5 August 1965, *M.S. Chrostowski s.n.*, field no. Lot 1 (WIS-2 sheets without flowers, topotypes). Cerro Campana, 500 m alt., *loma* formation near

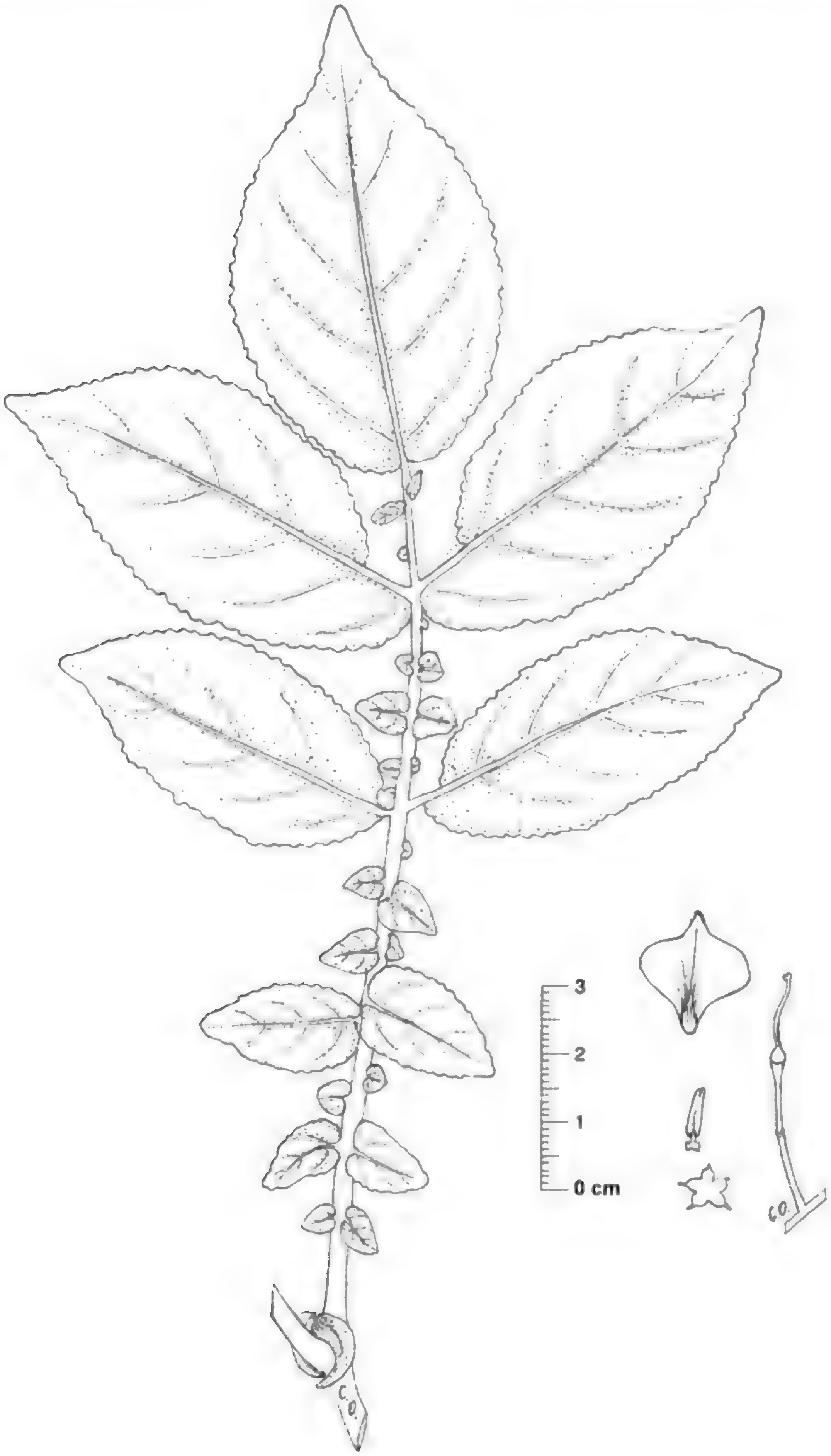


Figure 349. *Solanum mochiquense* Ochoa (*Ochoa 1822*, holotype).

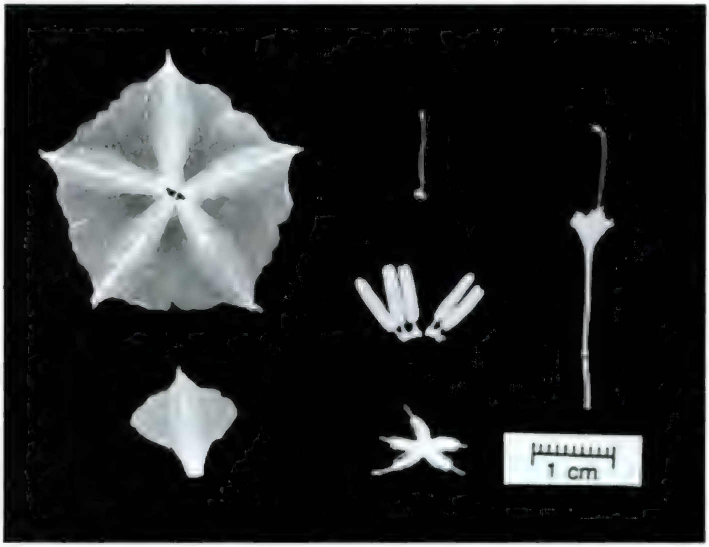


Figure 350. Floral dissection of *Solanum mochiquense* (*Ochoa3658*), from a specimen collected at Cerro Campana, near Trujillo, La Libertad.

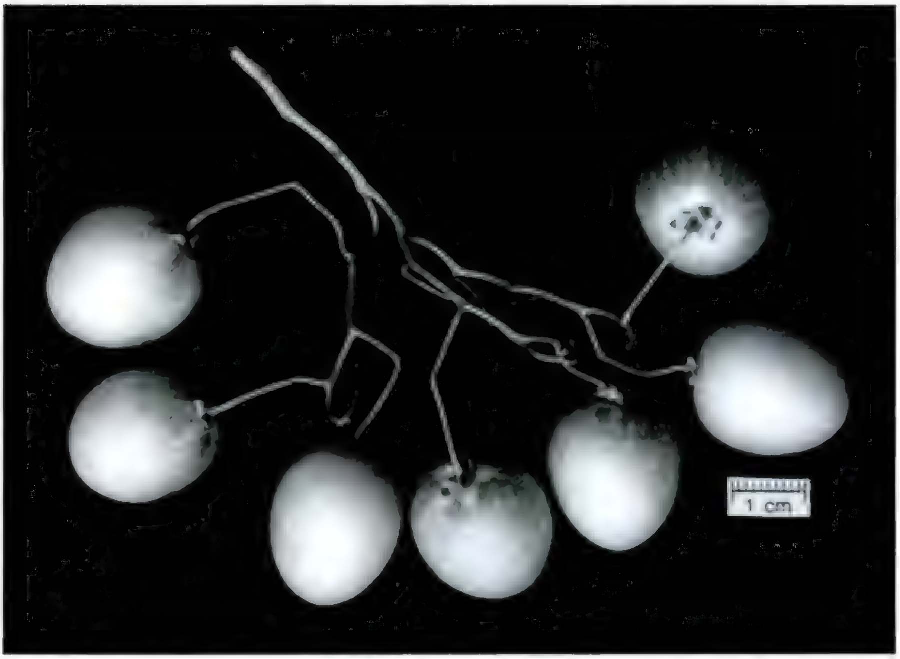


Figure 351. Fruits of *Solanum mochiquense* (*Ochoa 14820*).

Trujillo, only mature fruits collected, September 1972, *C. Ochoa 3658*, 2n=24 (OCH, from plants propagated at Universidad Nacional Agraria La Molina, Lima). Cerro Campana, 415 m alt., in loma formation near Trujillo, among rocks, 8 September 1980, *C. Ochoa and A. Salas 14870*, 2n=24 (CIP, MO, MOL, OCH, USM, topotypes of *S. mochiquense*).

Department Lima

Province Huaura: Cerro Chay, 350 m alt., between the *lomas* of Lupín and Supe, flowers white, in sandy-rocky soil, October 1970, *C. Ochoa 2880* (OCH). *Lomas* of Lupín, 350-400 m alt., near Supe, in sandy *lomas*, flowers white, October 1970, *C. Ochoa 2881* (OCH).

Department Piura

Province Huancabamba: Lower slopes of Cerro Mishihuaca, 1950 m alt., near Canchaque, 3 May 1960, *C. Ochoa 2313*, 2n=24 (OCH), original seed of this collection sent to Sturgeon Bay, Wis., U.S.A., under the label, *Ochoa S-20* (= *PI-365334*). Cerro Mishihuaca, 2000 m alt., near Canchaque, only mature berries collected, May 1972, *C. Ochoa 3657*, 2n=24 (MOL, OCH, USM, from plants propagated at Universidad Nacional Agraria La Molina, Lima). Southeast-

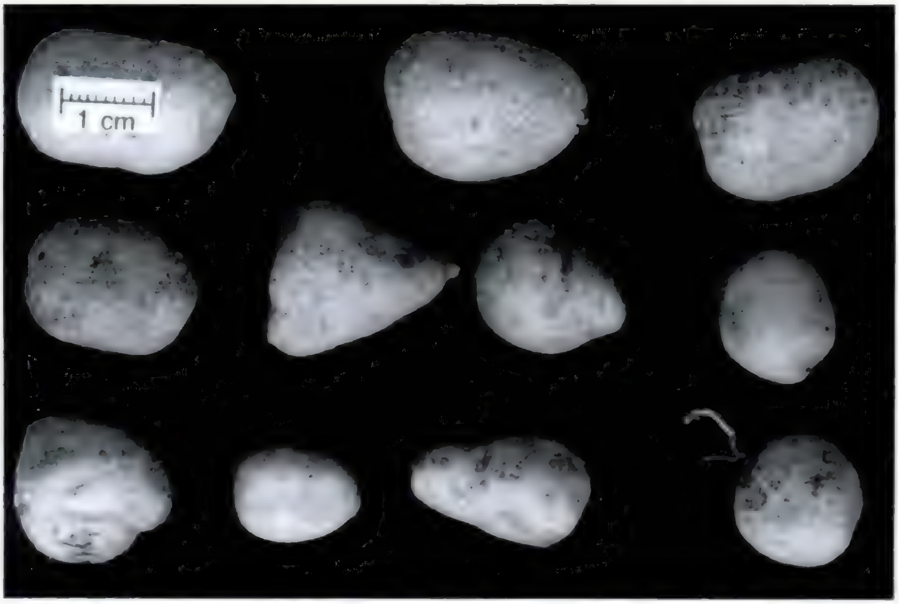


Figure 352. Tubers collected at Cerro Campana, near Trujillo, La Libertad, *Solanum mochiquense* Ochoa (*Ochoa 14870*).

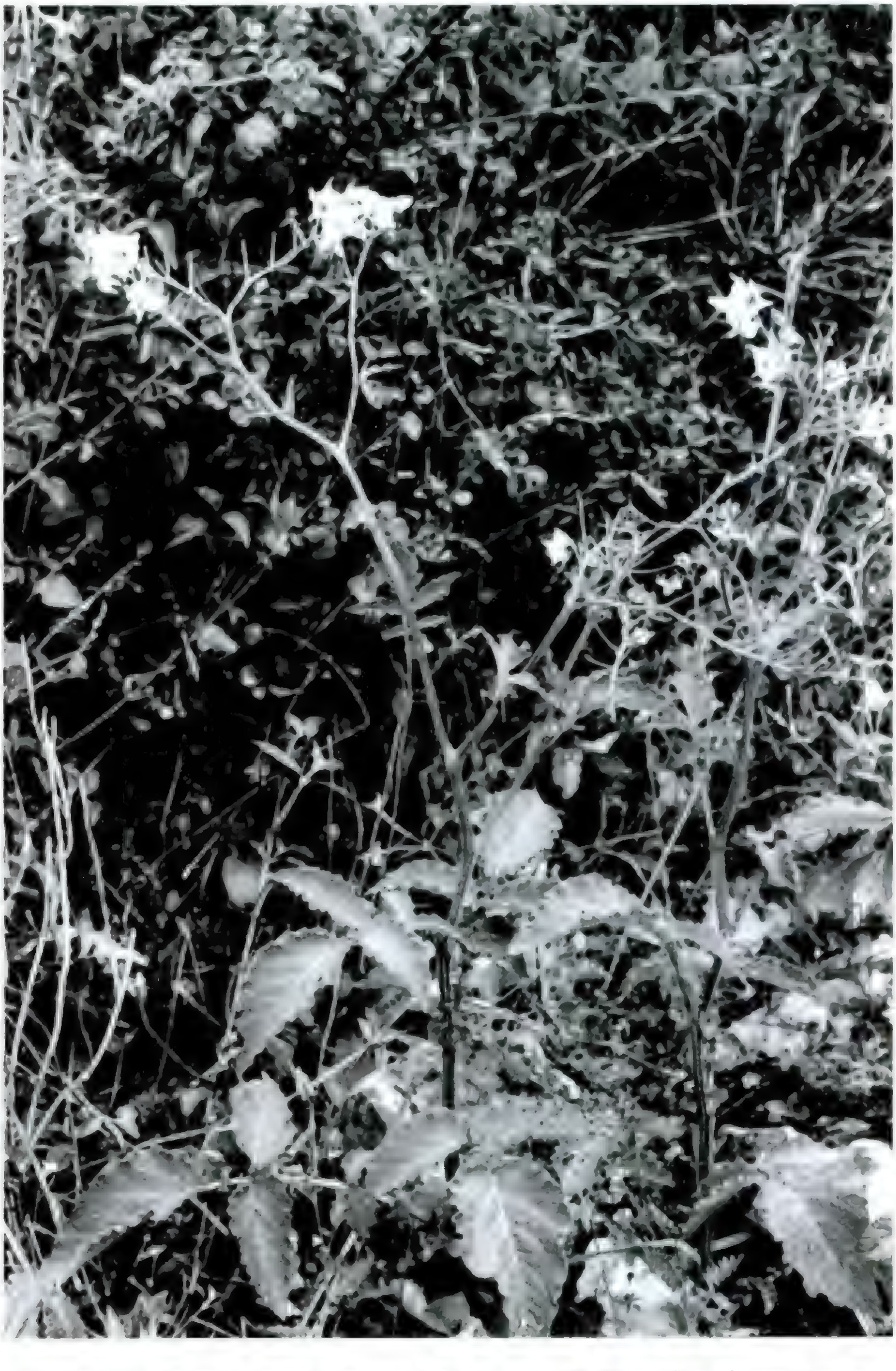


Figure 353. *Solanum mochiquense* Ochoa, near El Chorrillo, above Cascas, 2700 m alt., along the road to Contumazá, Province Contumazá, Cajamarca, May 1982.

ern side of Cerro Mishihuaca, 1850 m alt., near Canchaque, among moist mountain forests and banana fields, plant senescent, in fruit, scarce, tubers white, ovoid, 2-6 cm long, May 1982, *C. Ochoa 14820* (OCH).

Breeding Potential

The results of crosses of *S. mochiquense* with other diploid (2n=24) species of EBN=1 or EBN=2, tetraploids (2n=48) of EBN=2 and hexaploids (2n=72) of EBN=4 are given in Table 88, while the materials used in these experiments are shown in Table 89.

Solanum mochiquense is a self-sterile diploid species having an EBN value of 1. In reciprocal crosses of this species with other diploid, EBN=1 species of Series Tuberosa, such as *S. chancayense*, *S. incahuasinum*, *S. immite* and *S. wittmackii*, excellent seed set was found in each case, thus indicating great compatibility. Good seed set was also found in unilateral crosses of *S. mochiquense* with *S. dolichocremastrum* of Series Megistacroloba. However, when *S. mochiquense* was crossed with *S. lignicaule* of Series Lignicaulia, far fewer seeds per berry were produced, no matter in which direction the species were crossed. On the other hand, only few seeds were obtained in reciprocal crosses of *S.*

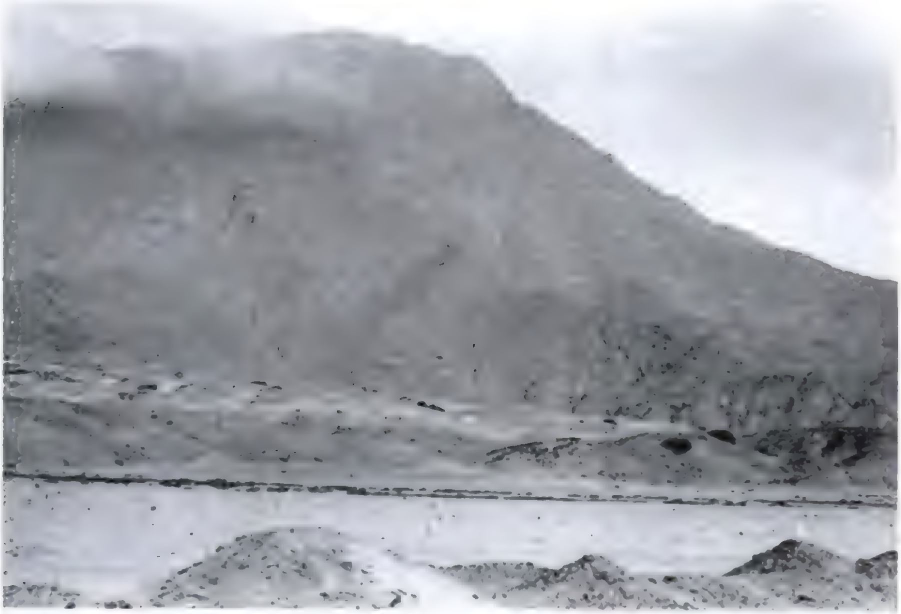


Figure 354. The dry mountain called Cerro Campana, near Trujillo, La Libertad, type locality of *Solanum mochiquense* Ochoa.

mochiquense with *S. hypacrarthrum* of Series Piurana, and then only when the latter species was used as the pistillate parent. Total incompatibility was found only with respect to one species, *S. guzmanguense* of Series Simplicissima.

At the EBN=2 level, mixed results were obtained when *S. mochiquense* was crossed with other plants of the Series Tuberosa. Moderate levels of compatiblity were found for crosses involving *S. mochiquense* and *S. huancabambense*, *S. multiinterruptum* and *S. medians-2x*, despite the fact that *S. mochiquense* is an EBN=1 species. Unilateral crosses involving *S. ancophilum*, *S. orophilum*, *S. coelestispetalum*, *S. incasicum* and *S. huarochiriense* were also moderately successful. However, compatibility in crosses of *S. mochiquense* with *S. tacnasense* was obtained only when *S. mochiquense* was used as the pistillate parent; whereas, compatibility in crosses involving *S. goniocalyx* and *S. candolleanum* was obtained only when *S. mochiquense* was used as the staminate parent.

With respect to interseries crosses, low seed set was obtained in unilateral crosses of this species with *S. irosinum* of Series Conicibaccata and *S. jalcae* of Series Ingaefolia, and very high seed set in unilateral crosses with *S. blanco-galdosii* of Series Cuneoalata.

Lastly, all crosses involving plants of either the Series Piurana or Acaulia were unsuccessful. Some failures were also encountered among the various species of Series Conicibaccata, Megistacroloba and Tuberosa (see Table 86).

Table 88. Fertility of *Solanum mochiquense* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	LIGNICAULIA	× *S. lignicaule*	14(4)	12(3)	33(11)
24	1	MEGISTACROLOBA	× *S. dolichocremastrum*	12	12	117
24	1	PIURANA	× *S. hypacrarthrum*	18(43)	0(16)	0(13)
24	1	SIMPLICISSIMA	× *S. guzmanguense*	22(11)	0(1)	0(0)
24	1	TUBEROSA	× *S. chancayense*	92(40)	58(33)	181(122)
			× *S. immite*	21(23)	11(18)	130(70)
			× *S. incahuasinum*	32(20)	29(20)	176(99)
			× *S. wittmackii*	50(64)	26(35)	102(48)
24	2	CONICIBACCATA	× *S. contumazaense*	22(5)	0(0)	0(0)
			× *S. irosinum*	18	6	23

			× *S. limbaniense*	24	6	0
24	2	CUNEOALATA	× *S.* × *blanco-galdosii*	13	1	200
			× *S. peloquinianum*	3(6)	3(4)	12(39)
24	2	INGAEFOLIA	× *S. jalcae*	14	1	23
24	2	MEGISTACROLOBA	× *S. raphanifolium*	20(3)	10(1)	0(0)
24	2	PIURANA	× *S. acroglossum*	9	0	0
			× *S. cantense*	25(22)	2(0)	0(0)
			× *S. chiquidenum*	13(16)	0(4)	0(0)
			× *S. piurae*	5(7)	0(5)	0(0)
24	2	TUBEROSA	× *S. amayanum*	5	0	0
			× *S. ambosinum*	10	10	0
			× *S. ancophilum*	28	12	110
			× *S. aymaraesense*	16	14	0
			× *S. bukasovii*	8	0	0
			× *S. candolleanum*	5(13)	3(6)	0(44)
			× *S. coelestispetalum*	4	2	53
			× *S. goniocalyx*	5(15)	4(8)	0(65)
			× *S. huancabambense*	10(65)	2(52)	83(48)
			× *S. huarochiriense*	12	2	6
			× *S. incasicum*	8	3	49
			× *S. longiusculus*	6	0	0
			× *S. marinasense*	11	3	0
			× *S. medians-2x*	63(14)	51(4)	8(35)
			× *S. multiinterruptum*	19(13)	16(12)	68(94)
			× *S. orophilum*	6	2	100
			× *S. phureja*	24(6)	19(4)	0(0)
			× *S. tacnaense*	42(23)	40(6)	28(0)
48	2	ACAULIA	× *S. acaule*	4	0	0
72	4	CONICIBACCATA	× *S. jaenense*	7	0	0
72	4	ACAULIA	× *S. albicans*	7	0	0

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 89. Collections (OCH) used in *Solanum mochiquense* (2x) fertility studies.

ACAULIA
S. acaule 11336
S. albicans 13238

CONICIBACCATA
S. contumazaense 14751
S. irosinum 15225
S. jaenense 14801
S. limbaniense 14288

CUNEOALATA
S. × *blanco-galdosii* 13009
S. peloquinianum 13002

INGAEFOLIA
S. jalcae 14488

LIGNICAULIA
S. lignicaule 13585

MEGISTACROLOBA
S. dolichocremastrum 12074
S. raphanifolium 7610, 8333, 13610A, 13626

PIURANA
S. acroglossum 11297
S. cantense 14664, 14681, 14692, 14828
S. chiquidenum 13963, 13965A
S. hypacrarthrum 11308, 13272, 14715, 14731
S. piurae 13960

SIMPLICISSIMA
S. guzmanguense 15989, 15990, 15991

TUBEROSA
S. amayanum 4299
S. ambosinum 11298
S. ancophilum 12086A, 12086B, 12099
S. aymarasense 13810
S. bukasovii 15201A
S. candolleanum 11835, 11896
S. chancayense 11250
S. coelestispetalum 13674
S. goniocalyx 00001
S. huancabambense 11619, 11626
S. huarochiriense 11331
S. immite 11689, 13346, 14491
S. incahuasinum 11613
S. incasicum 13631
S. longiusculus 13743
S. marinasense 13620, 14339
S. medians-2x 11884, 12047, 13140, 13185, 13268
S. mochiquense 14820, 14870, 15995
S. multiinterruptum 14524, 14694, 14718
S. orophilum 12079
S. phureja 13919, 15072, 15074
S. tacnaense 11609, 11612
S. wittmackii 10982, 11029, 11310, 11312, 11877, 13184, 13215, 13258, 13271

72. *Solanum multiinterruptum* Bitt., Fedde, Repert. Sp. Nov. 12:56-57, 1913.

Figs. 355-361; Map 25; Plate XXXIV.

S. moniliforme Corr., Wrightia 2:182, 1961. Type: PERU, Department Ancash, Province Recuay, at km 311, a few km below Conococha, 3900 m alt., 31 March 1960, *D. S. Correll and E. E. Smith P974* (K, LL, US).

S. multiinterruptum Bitt. f. *longipilosum* Corr., Wrightia 2:192, 1961. Type: PERU, Department Ancash, Province Bolognesi, above Chiquián, 31 March 1957, *R. Ferreyra and E. Cerrate 2131* (LL, OCH, USM).

Plant robust, bushy, erect-ascending, (30-)50-80(-120) cm tall, sparsely pilose, subglabrous or rarely glabrescent; stems vigorous up to 15 mm in dia., with sparsely distributed, long, white multicellular hairs, wings broad or narrow, straight or sinuous; internodes 2.0-4.5 cm long. Stolons more than 1 m long; tubers large, 8-10 cm long, very occasionally ovoid, 2-3 cm long and submoniliform. Leaves shortly petiolate, (11.5-)13.5-26.0(-37.5) cm long by (9.0-)10.5-16.0(-24.5) cm wide, more or less thinly covered with short pointed hairs above, the hairs shorter below and principally on the veins, veinlets and rachis; leaves imparipinnate with 3-4(-5) pairs of leaflets and (2-)5-10(-20) pairs of sessile, unequally-sized interjected leaflets. Leaflets broadly elliptic to obovate-elliptic to elliptic-lanceolate, with subobtuse or subpointed to pointed-apiculate apices and broadly rounded and oblique to subcuneate bases. Terminal leaflet (5.0-)6.5-11.0(-12.5) cm long by (2.6-)3.5-5.5(-6.0) cm wide, slightly larger than the laterals, broadly ovate-lanceolate to ovate, with subpointed or apiculate apices and rounded or slightly cuneate bases. Lateral leaflets sessile or shortly petiolulate, the first upper pair (3.5-)5.0-9.5(-11.0) cm long by (2.0-)2.5-5.0(-5.5) cm wide, usually somewhat decurrent about the rachis along the basiscopic side. Pseudostipular leaves broadly falcate, large, 10-15(-20) mm long by 6-8(-10) mm wide. Inflorescence terminal or lateral, cymose-paniculate with up to 35 flowers, very showy. Peduncle 17-20 cm long, forked, light green and puberulent or sparsely pilose, as in the case of the pedicels, hairs unequally long, glandular; pedicels long and slender, 30-45(-55) mm long, articulated very high, 2-4(-6) mm below the calyx. Calyx symmetrical, 6-7(-10) mm long, puberulent or with long and occasionally glandular hairs, rarely glabrous or subglabrous, pigmented or slightly pigmented; lobes ovate-lanceolate or lanceolate, abruptly narrowed to pointed acumens, 1.5-2.0 mm long, rarely apiculate. Corolla rotate, deep blue, sky-blue or purple (white in f. *albiflorum*), large, 3.5-4.5(-5.0) cm in dia., with pubescent acumen margins and yellowish-white to pale violet internal star. Anthers lanceolate, 6-7 mm long; filaments 1.5-2.5 mm long, glabrous. Style 11-12 mm

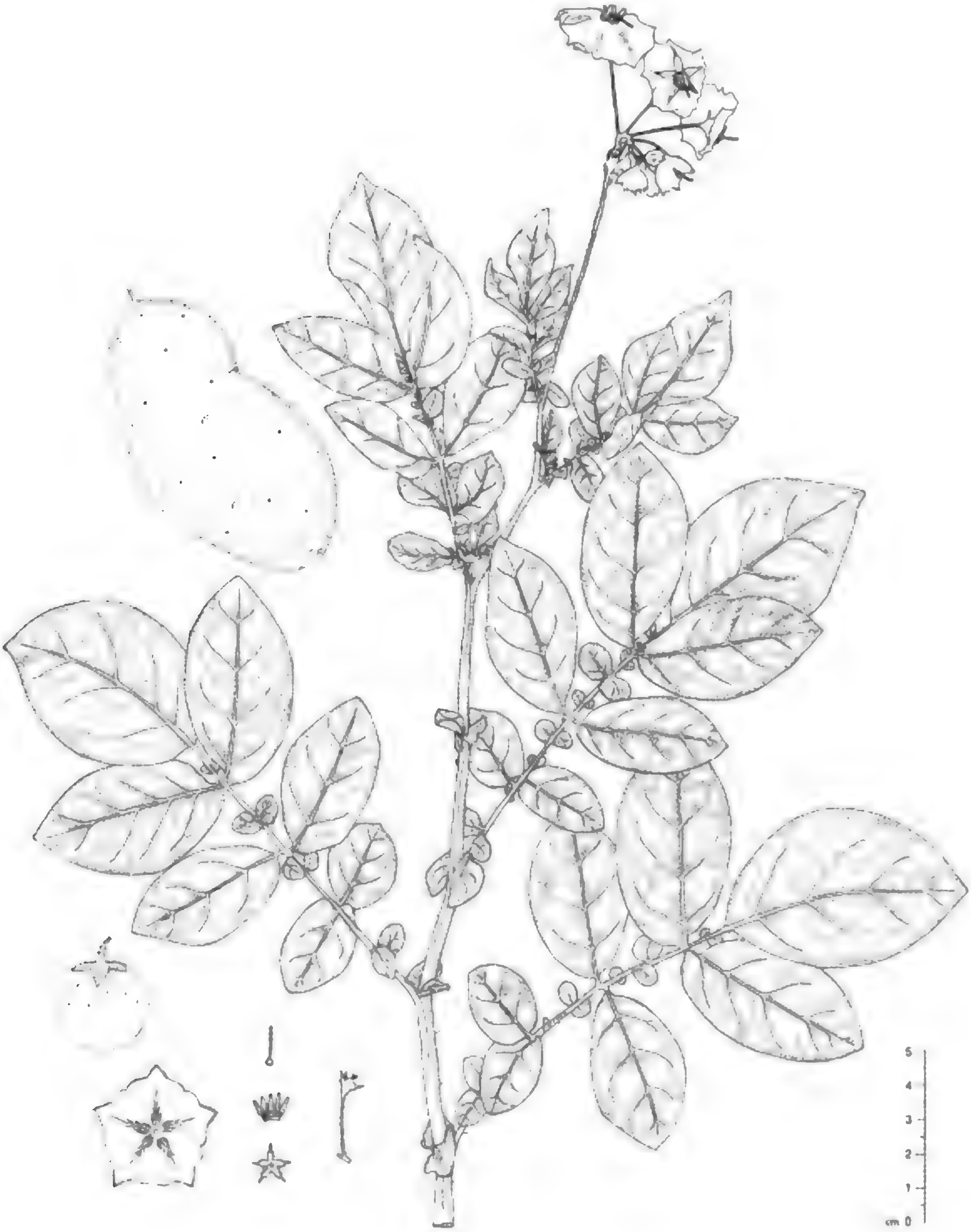


Figure 355. *Solanum multiinterruptum* (*Ochoa and Salas 12579*, flowers blue).

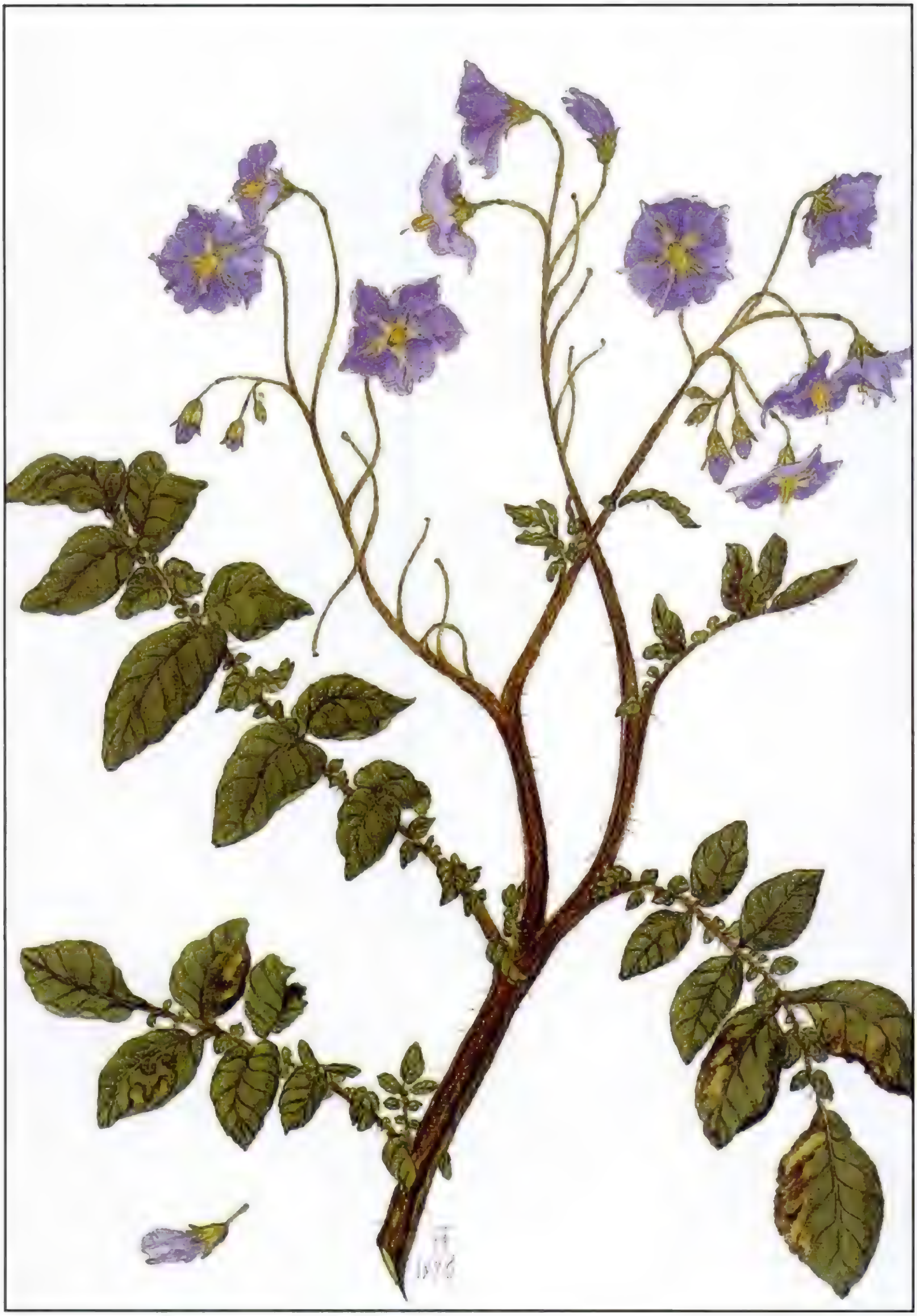


Plate XXXIV. *Solanum multiinterruptum* Bitt.

long, exerted 3 mm, papillose along the basal two-thirds of its length, very occasionally glabrous or subglabrous; stigma claviform or subglobose, cleft. Fruit globose to ovoid (fig. 360), obtuse at apex, 1.5-2.0 cm long, dark green at base, and yellowish-green flecked with white to well above center, but not verrucose at apex. Chromosome Number: 2n=24. EBN=2.

Local Names: The plant is called *Papa Cimarrona* and the fruit Quipán or *Ampulluco* in the vicinity of Huamantanga, Lima.

Type: PERU. Department Lima, [Province Canta], Huamantanga, 11,000 ft [3355 m alt.], "wild blue flowered" *McLean s.n.* (K holotype, here designated; GOET, drawing only).

Bitter's original description of *S. multiinterruptum* was based upon a single specimen that was collected by John McLean at Huamantanga. McLean, who is known to have resided in Peru between the years 1832-1854, labeled this collection "wild blue flowered" and sent it off to the Kew Herbarium, London, where this holotype specimen may be viewed today. However, there is still another specimen of this species in the Kew Herbarium that was collected by McLean at the same locality but labeled by him as "wild white flowered." Apparently, Bitter did not see this plant as it is not cited by him.

As a species, *S. multiinterruptum* is especially variable with respect to its indumentum. Although normally sparsely pilose, plants of this species can vary from glabrescent to glabrous. Moreover, the position of the pedicel articulation and the shape of the fruit varies to some extent in different collections. Most plants of this species (including those from the type locality Huamantanga) have pedicels that are articulated about 2-4 mm below the calyx cup, and bear globose fruits. However, other collections of this species, such as *OCH 15702*, *15709* and *15010* from the Department of Ancash, have the pedicels articulated about 5-8 mm below the calyx cup and bear ovoid or long-conical fruits. Still other specimens of this species show variations in flower color. The corolla, for example, may vary from deep blue, sky-blue or purple and violet to pure white in f. *albiflorum*. In some cases, colors intermediate between the standard ones have come about in nature as the result of crosses between plants of different flower color.

Affinities

Solanum multiinterruptum is similar to *S. bukasovii* in having leaves that bear numerous interjected leaflets. However, the two species differ substantially in stem height and in plant habit. Moreover, from the genetic standpoint, these two

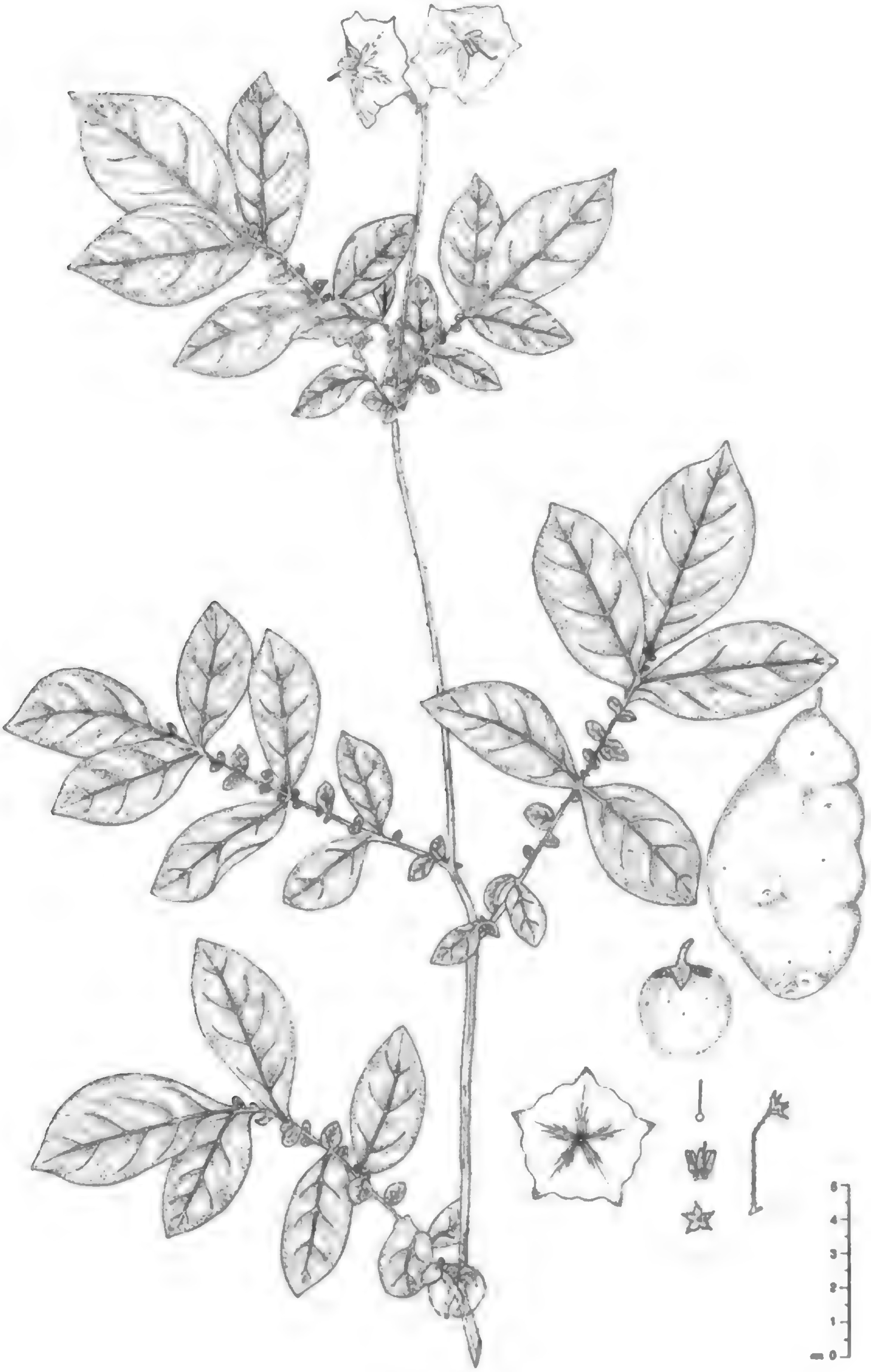


Figure 356. *Solanum multiinterruptum* (*Ochoa and Salas 12586*, flowers sky-blue).

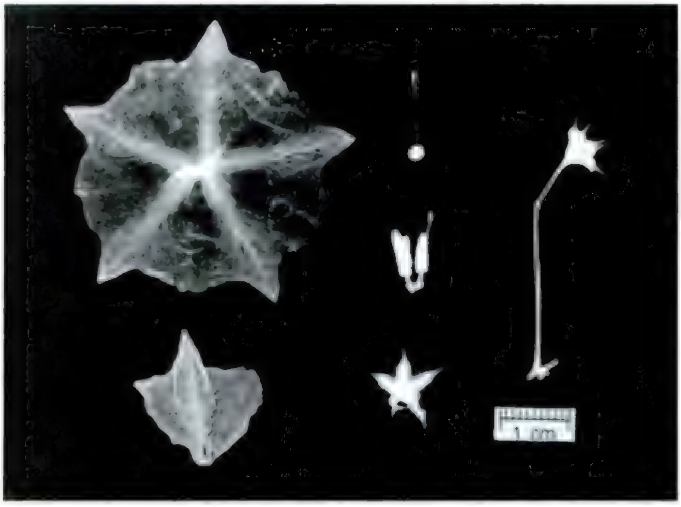


Figure 357. Floral dissection of *Solanum multiinterruptum* (*Ochoa and Salas 12586*, flowers sky-blue).

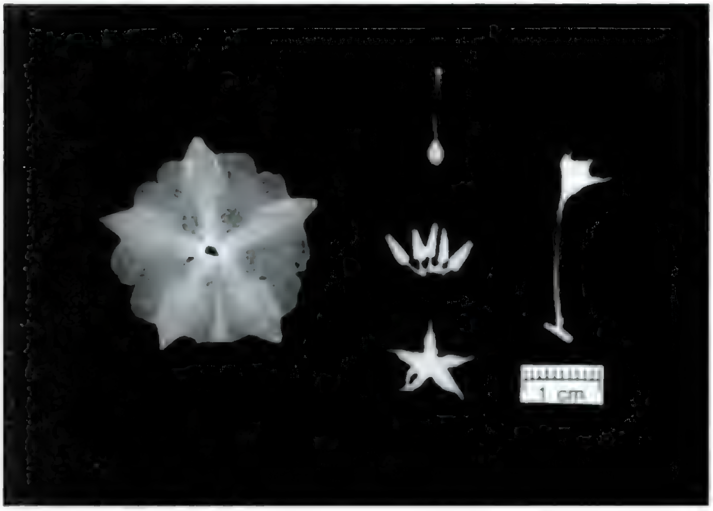


Figure 358. Floral dissection of *Solanum multiinterruptum* (*Ochoa and Salas 12579*, flowers blue).

species would appear to be distantly related as only few seeds are obtained in reciprocal crosses, and then only when *S. multiinterruptum* is used as the staminate parent.

A much closer relationship between species is found in comparisons of *S. multiinterruptum* with *S. ambosinum*. Both are similar in habit, pilosity and overall leaf shape (but not dissection), and both species are known on occasion to produce very large tubers. Also, these two species are very cross-compatible, yielding as much as 180 seeds per berry, on the average.

Habitat and Distribution

This species is a member of the high, cool *puna* or *jalca* formations of Peru. Of the more than 180 collections of this species that were included in this study, nearly 170 were from localities situated between 3000 and 4100 m above sea level, while the remainder (less than a dozen) came from altitudinal zones that were located between 2100 and 2800 m. *Solanum multiinterruptum* is typically found in rocky or rocky-clay soils among boulders, cliffs and stone walls, or on mountain slopes in moist, well-drained soils. It is known from thickets, moist forests and even grasslands. At various locations throughout its range, it grows with trees of *Buddleja* or *Polylepis*, shrubs of *Berberis*, *Barnedisia*, *Cantua*, *Chuquiraga*, *Salpichroa* and *Mutisia*, columnar or cylindrical cacti such as

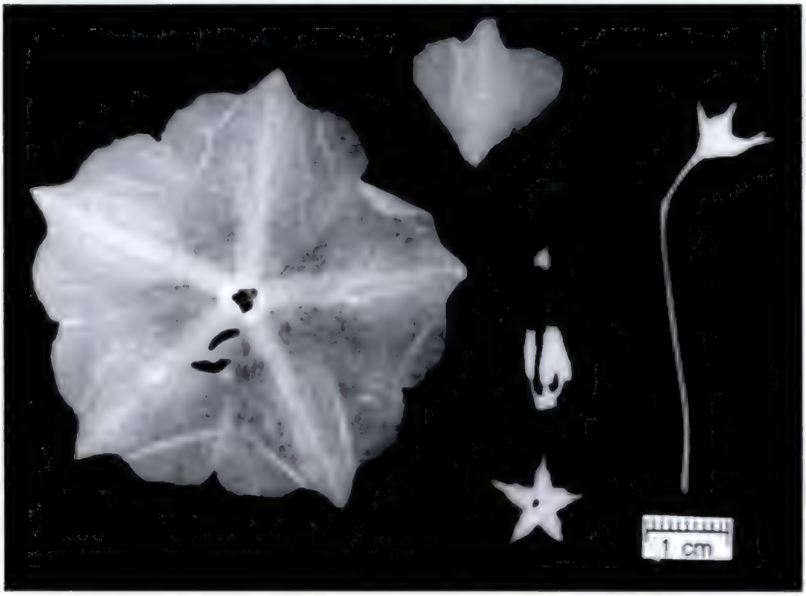


Figure 359. Floral dissection of *Solanum multiinterruptum* f. *albiflorum* (*Ochoa and Salas 12584*).

Trichocereus and *Opuntia exaltata*, and herbs such as *Astragalus*, *Poa*, *Festuca*, *Stipa*, *Calceolaria*, *Bidens*, *Oenothera*, *Plantago* and *Urtica*. On the western slopes of the mountains in the Department of Lima, this species grows in association with several other tuberous species of *Solanum*, including *S. medians*, *S. cantense*, *S. hypacrarthrum* and *S. wittmackii*.

Solanum multiinterruptum is distributed in the Province of Castrovirreyna, Department of Huancavelica; in the central sierras of the Provinces of Cajatambo, Canta, Huarochirí and Yauyos, Department of Lima; and, in the high sierras of the Provinces of Aija, Bolognesi, Huarez and Recuay, Department of Ancash in northern Peru. It is also represented further much north in the Province of Otuzco, Department of La Libertad, by the var. *machaytambinum* (Map 25).

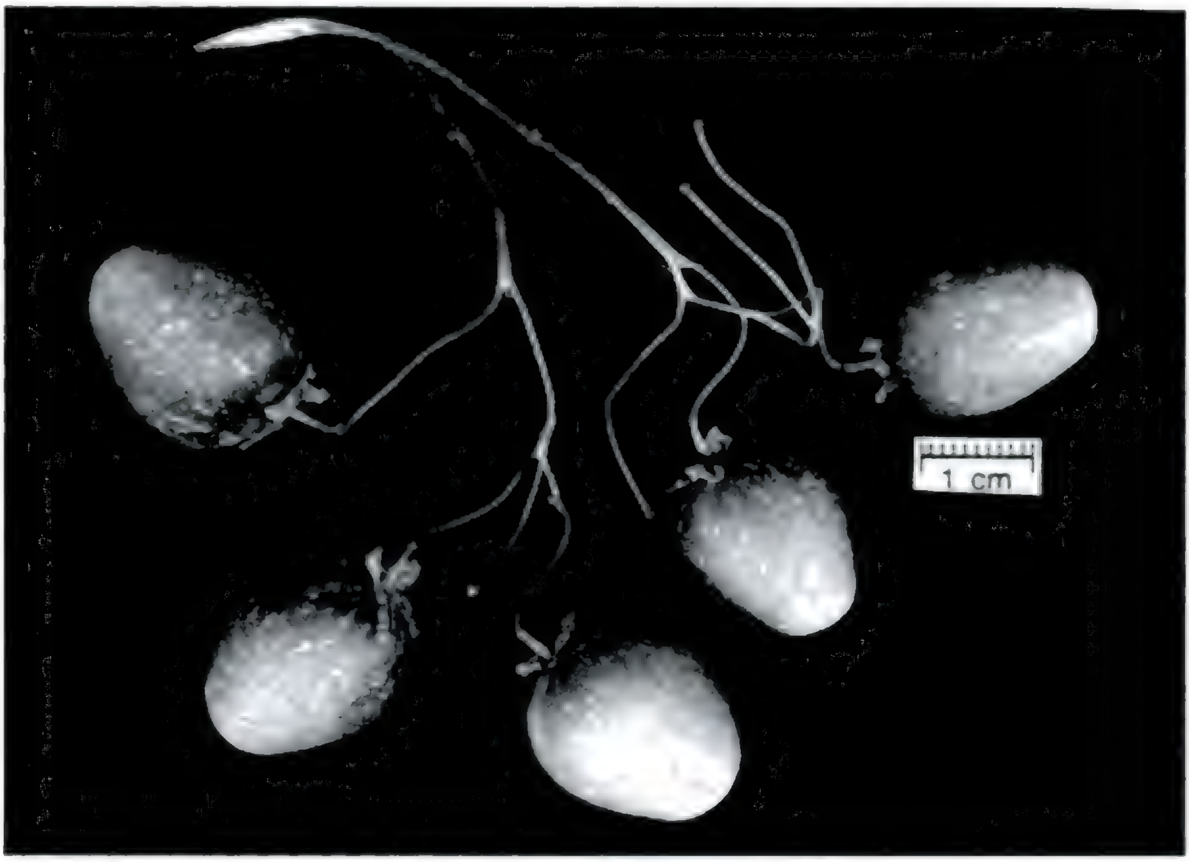


Figure 360. Fruits of *Solanum multiinterruptum* (*Ochoa 15186*).

Specimens Examined

Department Ancash

Province Aija: Malde, 3200 m alt., along the route from Huayán to Wuamanwillca, in thickets on moist talus slopes, 17 April 1970, *C. Ochoa 2721*, 2n=24 (CIP, OCH, US). Highlands of Rucash, near Wuamanwillca, along the route to Tacarpo, 3500 m alt., in a rocky area, flowers very pale blue, nearly white, 7 April 1970, *C. Ochoa 2725*, 2n=24 (CIP, OCH, US). Cerro Wuamanwillca, 3500 m alt., near the crest, in a rocky area along the Huayán-Tacarpo road, 7 April 1970, *Ochoa 2726* (OCH, US). Quimapunco, 3500 m alt., near Wuamanwillca, between Huayán and Wuamanwillca, 7 April 1970, *C. Ochoa 2727* (F, MOL, NY, OCH, US). Koshcca, 3500 m alt., between Huayán and Quimapunco, along the route to Wuamanwillca, 1 April 1970, *C. Ochoa 2728* (MOL, NY, OCH, US). Huancucha, 3450 m alt., between Quimapunco and Wuamanwillca, along the Huayán-Tacarpo road, flowers large, blue-violet, 4.5 cm in dia., April 1971, *C. Ochoa 2975* (OCH). Between Quimapunco and Wuamanwillca, 3300 m alt., heading up from Huayán along the route to Tacarpo, April 1971, *C. Ochoa 2976* (OCH). Carap, 3500-3700 m alt., in the highlands of Huayán, heading up from Wuamanwillca to Huarmán, plants robust 1.20 m tall, flowers large, 4 cm in dia., bluish, April 1971, *C. Ochoa 2977* (OCH). Between Wuamanwillca and Carap, 3500 m alt., on the ascent to Huarmán, in rocky soil,

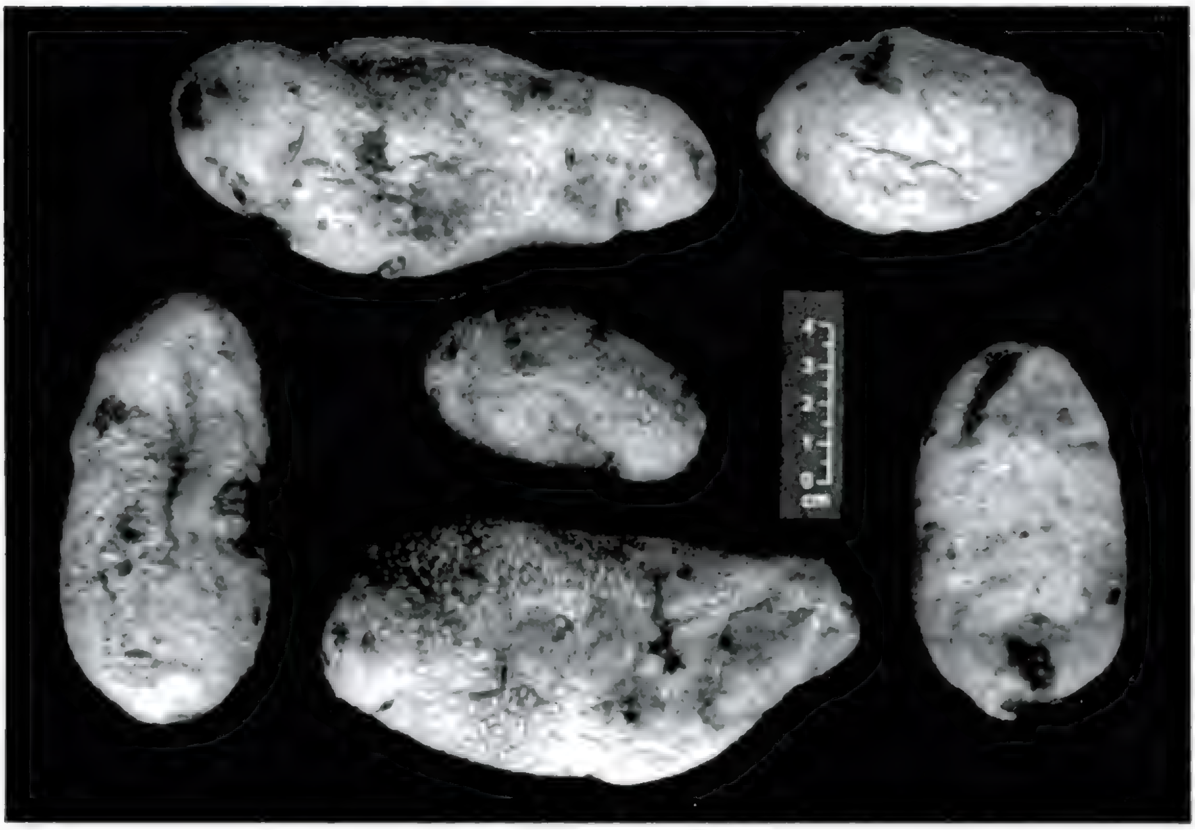


Figure 361. Tubers of *Solanum multiinterruptum* (*Ochoa 11690*).

on the slopes of a mountain, April 1971, *C. Ochoa 2978* (OCH). Between Carap and Huarmán, 3700 m alt., in poor soil, sandy-rocky, April 1971, *C. Ochoa 2979* (OCH). Near the water source of Huarmán, 3800 m alt., on a mountain slope, April 1971, *C. Ochoa 2980* (OCH). Cuchucuchu, near the water source of Huarmán, 3900 m alt., highlands of Huayán, in moist ground, April 1971, *C. Ochoa 2983* (OCH), *2984* (CIP, MOL, OCH) and *2986* (MOL, OCH, US). Banks of the Volcán River, 3000 m alt., near the Monserrate bridge, along the Huayán-Aija road, in clay soil, plants robust flowers large, 2 May 1972, *C. Ochoa 3316* (OCH). Cuesta del Mellizo, heading up from Huayán to Aija, 3200 m alt., 2 May 1972, *C. Ochoa 3318* (OCH). Canchinchán, 3350 m alt., heading up via the Cuesta del Mellizo to Aija, 2 May 1972, *C. Ochoa and D. Luna 3319* (OCH). Tullupecto, 3300 m alt., near Huayán along the railroad line to Malvas, above Aldave, in thickets, 20 April 1977, *C. Ochoa 11690*, 2n=24 (CIP, OCH). Llusupuquio, 3000 m alt., near Huayán, 20 April 1977, *C. Ochoa 11691* (CIP, OCH). Cashacoto, 3200 m alt., above Aldave, near Huayán, forming colonies of many plants, 20 April 1977, *C. Ochoa 11693*, 2n=24 (OCH). Luyajhuanca, 2700 m alt., along the route Cashacoto-Huayán, flowers light sky-blue to whitish, 20 April 1977, *C. Ochoa 11694* (CIP, OCH). Huancucha, 3700 m alt., past Cerro Wuamanwillca in the Unilateralion of Tacarpo, flowers lilac, 20 April 1977, *C. Ochoa 11695*, 2n=24 (CIP, MOL, OCH, US). Mal Paso, 3850 m alt., highland water source of Huarmán, vicinity of Huayán, 22 October 1978, *C. Ochoa 11696* (floral dissection only). Between Aija and Munpag, 3075 m alt., near Monserrate, west of the Monserrate River, among stones and some plants of *Opuntia exaltata* and *Poa* sp., 22 March 1979, *C. Ochoa 13234*, 2n=24 (OCH, US). Heading up to Cuchucuchu, 3500 m alt., between Wuamanwillca and Sequipoquián, flowers sky-blue, large, 4 cm in dia., 23 April 1983, *C. Ochoa 15161* (CIP, MOL, OCH, US). Tranca, 3200 m alt., below Cancha Uchucuna, near Huayán, flowers sky-blue, 23 April 1983, *C. Ochoa 15166*, 2n=24 (CIP, OCH). On the ascent of Huayán to the Cuesta del Mellizo, 3200 m alt., flowers blue, 23 April 1983, *C. Ochoa 15186*, 2n=24 (CIP, MOL, OCH). Monserrate, 3200 m alt., Aija, 18 March 1987, *F. de la Puente s.n.* (CIP).

Province Bolognesi: Cerro Matarragra, 3520-3560 m alt., northwest of Chiquián, in mountain *pluviifolio* on clay soil, plant 40-60 cm tall, n.v. *Papa del Gentil*, 8 April 1949, *E. Cerrate 003* (OCH, USM). Road to Huancar, 3700-3800 m alt., above Chiquián, in mountain *pluviifolio* under shrubs, flowers purple, n.v. *Papa del Gentil*, 15 April 1949, *E. Cerrate 188* (OCH, USM). Capillapunta, mountain above Chiquián, 3540 m alt., in moist soil under shrubs, flowers purple, 14 April 1949, *E. Cerrate 342* (OCH, USM). Huancar, 3860 m alt., above Chiquián in clay soil under shrubs, flowers blue-sky blue, n.v. *Papa del Gentil*, scarce, 26 April 1949, *E. Cerrate 345* (OCH, USM). Near Chiquián, 3340-3390 m alt., flowers purple, in clay soil, 14 May 1950, *E. Cerrate 624* (MOL, OCH, USM). Chupa, mountain to the west of Aquia, 3200-3250 m alt., plants 50-80 cm tall, flowers purple, 18 May 1950, *E. Cerrate 719* (OCH, USM). Parampún, mountain south of Chiquián, 3600 m alt., flowers purple, 26 April 1952, *E. Cerrate 1353* (OCH, USM). Colquimarca, 3800 m alt., heading up by the quebrada of La fortress to the lagoon of Conococha, plants very vigorous 0.80-1.00 m tall, leaflets elliptic-lanceolate, flowers purple-lilac 3 cm in dia., n.v. *Atokkpa-Papan*, 6 May 1952, *C. Ochoa 1417* (CIP, MOL, OCH, US). Above Chiquián, 3500-3600 m alt., in clay on rocky hillsides, flowers purple, 31 March 1957, *R. Ferreyra and E. Cerrate 12131* (LL, OCH, USM, type collection of *S. multiinterruptum* f. *longipilosum* Correll). Timpo, *ca.* 3200 m alt., near Purish on the Pancal-Chiquián road, 2 March 1962, *C. Ochoa and F. de la Puente 2396* (OCH). Huata, 3300 m alt., on the Chiquián-Pancal road, among stones and weeds, 2 March 1962, *C. Ochoa and F. de la Puente 2397* (OCH) and *2398* (CIP, MOL, OCH, US). Between Chiquián and the lagoon of Conococha, 3450 m alt., 15 April 1963, *C. Ochoa 2492* (CIP, MOL, NY, OCH, US). Vicinity of Ocros, 3300 m alt., in thickets, 20 March 1978, *C. Ochoa 12052*, 2n=24 (OCH). Oncoy, 3400 m alt., between Ocros and Raján, 20 March 1978, *C. Ochoa 12053*, 2n=24 (MOL, OCH, US), and *12054*, 2n=36 (CIP, GH, MOL, NY, OCH, UNTC, US, USM). Camasichiqui, 3600 m alt., above Oncoy, District of Ocros, berries ovoid, light green, densely spotted with white dots, flowers large, purple, 20 March 1978, *C. Ochoa 12055*, 2n=24 (CIP, MOL, OCH, US). Parana, 3600 m alt., 20-22 March 1978, *C. Ochoa 12057*, 2n=24 (CIP, OCH, US). Llipa Mine, 3600 m alt., near Raján, flowers purple, 20-22 March 1978, *C. Ochoa 12060*, 2n=24 (CIP, MOL, NY, OCH, UNTC, US).

Province Huaraz: Jupash, 3350 m alt., plants up to 3 ft. tall, large, flowers lavender-purple, rotate, tubers large, compressed, up to 5 cm long, eaten by natives, commonly called *Coro*, plants abundant on steep brushy slope, 28 March 1960, *D.S. Correll and E.E. Smith P950* (LL, MO, NY, US, USM). Huellap, ca. 3500 m alt., hamlet of Quishuar, near Pira, 25 June 1977, *C. Ochoa 11704* (CIP, OCH, UNTC, US). Highlands of Quishuar, 3650 m alt., near Pira, June 1977, *C. Ochoa 11705*, 2n=24 (CIP, GH, OCH, UNTC, US). Chamlla, 3500 m alt., near Pampas, on the slopes of a mountain, in organically rich rocky soil, plants robust 1 m tall with large tubers, ovoid, 8 cm long, 9 June 1983, *J. Espejo Ruiz 003* (OCH). Chamlla, 3500 m alt., near Pampas, on organically rich rocky slopes, plants vigorous 1 m tall, flowers pale lilac, almost white, large, 4 cm in dia., 9 June 1983, *J. Espejo Ruiz 004* (CIP, OCH) and *005*, 2n=24 (CIP, OCH, US). Chamlla, 3750 m alt., about 15 km northwest of Huanchay, 4 May 1984, *C. Ochoa and A. Salas 15733A* (CIP, MOL, OCH, USM). Quishuar, 3550 m alt., in moist black rocky soil, plants vigorous up to 1 m tall, stem triangular, winged, flowers sky-blue, large, 4.5 cm in dia., growing among trees of *Buddleja* or "Quishuar" and thickets of nettles, calceolarias, grasses, composites, 4 May 1984, *C. Ochoa and A. Salas 15739* (CIP, MOL, NY, OCH, US).

Province Recuay: At km 311, a few km below Conococha on road to coast, 3900 m alt., among boulders of west side of mounts, plants robust, much branched at base (specimen made from part of single branch), flowers lavender with darker stripe on back of petals, broadly rotate-stellate, tubers white, irregular, arranged as a necklace, 31 March 1960, *D.S. Correll and E.E. Smith P974* (K, LL, US, type collection of *Solanum moniliforme*). About km 306 on road from Conococha to coast, 3700 m alt., on grassy slope of stream bank, plants large, simple or much branched, to 4 ft. tall, flowers lavender-blue to purplish, rotate to broadly stellate, tubers elipsoid, to 4.5 cm long, 31 March 1960, *D.S. Correll and E.E. Smith P976* (F, LL, US). Shanquirajra, 3875 m alt., heading up from Chiquián to Conococha, 15 April 1963, *C. Ochoa 2493* (CIP, F, MOL, NY, OCH, US). Colquimarca, 3750 m alt., heading down from Conococha to the coast by the quebrada of La fortress, flowers purple, 18 April 1963, *C. Ochoa 2499* (CIP, OCH, US). Shacta, 3400 m alt., between Vinoc and Colquimarca, along the route from Conococha to the coast via the quebrada of La fortress, 18 April 1963, *C. Ochoa 2500* (CIP, F, MOL, NY, OCH, US). Near km 306 of the Lima-Huaraz road, 3900 m alt., heading up by the quebrada of La fortress to the lagoon of Conococha, 3 March 1969, Leg. *J. Espejo Ruiz s.n.* (OCH). Sicsibamba, 3650-3850 m, near Conococha, heading up from the coast by the quebrada of La fortress, plants 50-80 cm tall, flowers dark purple 3 cm in dia., 12 April 1978, *C. Ochoa 12064* (OCH*), 12065,* 2n=24 (CIP, OCH), *12066*, flowers blue (CIP, NY, OCH, US), *and 12096*, 2n=24 (CIP, OCH, US). Milluspuente, near Conococha, 3900 m alt., near the end of quebrada of La fortress, further above Colquimarca, corolla rotate, light purple, with very short acumens, articulated near calyx, 19 April 1978, *C. Ochoa 12095*, 2n=24 (CIP, OCH). Colquimarca, 3600 m alt., at the top of km 110 of the route Pativilca-Huaraz, among large rocks, in moist organically rich soil, protected by *Opuntia* sp. and nettles, associated with calceolarias, wild *ollucos* (*Ullucus* sp.), wild *mashua* (*Tropaeolum* sp.), composites and grasses, plants very vigorous up to 80 cm tall, stem thick and winged, tubers typical of *S. multiinterruptum*, long subcylindrical or long flattened, large, 7-8 cm long, 30 April 1984, *C. Ochoa and A. Salas 15702, 15709*, 2n=24, *15710*, 2n=24 (CIP, F, MOL, NY, OCH, UNTC, US, USM), *15716, 15717*, 2n=24, *15718* and *15720*, 2n=24 (CIP, F, MOL, NY, OCH, US), *15715*, 2n=24 (CIP, MOL, NY, OCH, US), and *15719* (CIP, F, MOL, OCH, US). Colquimarca, 3600 m alt., near km 111 of the Paramonga-Huaraz road, among rocks on gravel slopes, plants robust up to more than 1.2 m tall, branched, 7 April 1995, *C. Ochoa and A. Salas 16221* (CIP, MOL, OCH, UNTC, US, USM).

Department Huancavelica

Province Castrovirreyna: Near Córdova, 3050-3300 m alt., in grassland and moist rock walls, open *loma*, plants 30-75 cm tall, stem brittle, leaves soft, base of stem with white hairs, flowers baby blue, with greenish white stripes, 27-28 March 1954, *Metcalf 30257* (GH, US).

Department Lima

Province Cajatambo: Huaylancona, 3600 m alt., about 3 km east of Cajatambo, flowers lilac, growing near *S. medians*, 31 January 1979, *C. Ochoa 13143*, 2n=24 (OCH). Near ruins of Marca Marca, 3800 m alt., between Yarihuatum and Quichas, along the route from Oyón to the Raura Mines, berries typically of *S. multiinterruptum*, globose to long pyriform, verrucose, densely spotted with white dots, upper pedicel very short, articulated 2-3 mm below the base of the calyx, flowers violet, 31 January 1979, *C. Ochoa and A. Salas 13150*, 2n=24 (CIP, MOL, OCH, UNTC, US, USM). Quinanhuay, 4100 m alt., 8 km east of Oyón, flowers large, blue, this collection is the same as *Ochoa-Salas 13150*, 31 January 1979, *C. Ochoa and A. Salas 13152*, 2n=24 (CIP, MOL, OCH, UNTC, US, USM). Cachirca, 3700 m alt., small and narrow quebrada, along the route Cajatambo-Cajamarquilla, 5 km before Cajamarquilla, District Cajatambo, with *Barnadesia* sp., berries round or globose, light green, densely spotted with very small white dots and verrucose, corolla blue-violet, 3 cm in dia., 13 April 1982, *C. Ochoa 14669* (CIP, OCH, US, USM). Quichua, 3000 m alt., above Agén, south of Acaín, District Pachangará, flowers purple, 13 April 1982, *C. Ochoa 14677* (OCH). Manco Cona, 3400 m, 3 km west of Caujul, berries globose, green, densely sprinkled with white dots, verrucose, 13 April 1982, *C. Ochoa 14683* (CIP, OCH, US).

Province Canta: Capra Cancha, 3200 m alt., between Culhuay and Canta, plant robust more than 1 m tall, flowers large, 3-4 cm dia., sky-blue or light blue, tubers large, 5-7 cm long, oval-flattened, 24 March 1951, *C. Ochoa 1141* (OCH, US) and *1142* (GH, OCH). Cuesta de Huamantanga, 3500 m alt., on rocky slopes, plants robust sparsely pilose flowers large, light blue with white acumens or entirely blue, 30 March 1953, *C. Ochoa 2050* and *2051* (topotypes OCH). Among boulders, along road above Canta, 3400 m alt., plants unusually hispid, leaves rough, without flowers, tubers round to ellipsoid, 7 March 1958, *D.S. Correll, E.E. Smith and R. Ferreyra P291* (F, NY). Ubiquitous along road below Culluay on road from Lima to Canta, 3500 m alt., plants tall and showy with a long peduncle and many bluish-purple flowers, 7 March 1958, *D.S. Correll, E.E. Smith and R. Ferreyra P293* sheet 2 (LL). On rock slide below Culluay on road to Canta, 3600 m alt., plant robust, stem and rachis purplish, flowers deep purple, up to 4.5 cm in dia., rotate-stellate, tubers very irregular, 7 March 1958, *D.S. Correll, E.E. Smith and R. Ferreyra P295* (F). Among rock fences near Culluay, 3800 m alt., plants enormous, much-branched, up to 6 feet tall and wide, flowers large, deep purple, rotate, tubers with purplish skin and flesh, 7 March 1958, *D.S. Correll, E.E. Smith* and *R. Ferreyra P296* (NY). Near Canta, 3000-3200 m alt., in rocky foothills, flowers purple with whitish apex, 7 March 1958, *R. Ferreyra, E. Smith and D.S. Correll 12953* (OCH, USM). Near Culluay, 3600-3700 m alt., between Canta and La Viuda, flowers violet darker at base, immediate vicinity of the *puna*, near grassland, 7 March 1958, *R. Ferreyra, E. Smith and D.S. Correll 12959* (OCH, USM). Near Culluay, 3600-3800 m alt., between Canta and La Viuda, flowers purple, apex white spotted, near puna grassland, 7 March 1958, *R. Ferreyra, E. Smith and D.S. Correll 12966* (OCH, USM). Vicinity of Canta, 3000 m alt., 18 April 1960, *C. Ochoa 2154* (OCH). Cuesta de Huamantanga, 3400-3500 m alt., in rocky soil, 18 April 1960, *C. Ochoa 2309* and *2310* (topotypes OCH). Near Huamantanga, almost at the end of the crest, 3500 m alt., flowers sky-blue, large, almost 5 cm in dia., plant robust stems winged, 29 April 1963, *C. Ochoa 2501* (CIP, F, MOL, NY, OCH, US, USM, topotypes). At the beginning of the ascent to Cuesta de Huamantanga, 2700 m alt., flowers light-blue, April 1964, *C. Ochoa 2577* (OCH). 12 km before San José Bridge, 2100 m alt., a little past the detour of the trunk road Lima-Canta to Huamantanga, flowers blue, April 1964, *C. Ochoa 2578* (OCH). Canta, 2850 m alt., February 1967, *J. Soukup 3312*, Leg. Fr. Riccio (OCH). Chuculhuayque, 3650 m alt., Lachaqui, n.v. *Papa de Añaz* [= Papa de Zorrino or Zarigueya], among stones and enclosures in abandoned land and in cattle manure, plants large, 90 cm tall, flowers blue, large, 20 April 1972, *G. Vilcapoma 8* (OCH). Lachaqui, 3650 m alt., n.v. *Papa de Añaz*, in foothills of a somewhat moist mountain, 19 May 1973, *G. Vilcapoma 178* (OCH). Lachaqui, 3700 m alt., in a grassland forming community, rocky hillside, flowers purple, n.v. *Papa de Zorro*, 10 February 1974, *G. Vilcapoma 198* (CIP, OCH, US). Canta (Ligua) highway to Huaros, in sandy-clay ground, 13 April 1974, *G. Vilcapoma 215* (CIP, F, OCH, UNTC, US). Huaros, 3580 m alt., at km 128 of the Lima-Huaros road, in rocky ground, 14 April 1974, *G. Vilcapoma 216* (CIP, NY, OCH, US). Culluay, 3500-3600 m alt., on rocky hillsides, flowers purple, 14 April 1974, *G. Vilcapoma 217* (CIP, NY, OCH, US). Pariamarca, 3700 m alt., April 1974, *G. Vilcapoma 220* (CIP, NY, OCH, US). Carhua, 2700 m alt., April, 1974, *G. Vilcapoma 221* (CIP, F, NY, OCH, US). Lachaqui, 3500-3700 m alt., April 1974, *G. Vilcapoma 222* (CIP, NY, OCH, US). Apio, near Viscas, 2800 m alt., below Lachaqui, 14 April 1974, *G. Vilcapoma 224* (CIP, OCH). Huamantanga, 3500 m alt., among pasture grasses and shrubs, 8 May 1974, *G. Vilcapoma 227* (CIP, OCH, US). Canchamayo, 3600 m alt., near banks of the Chillón River, n.v. *Papa Abuelo*, 10 May 1977, *C. Ochoa 11303* (OCH). Vicinity of Canta, 2880 m alt., in shrubby thickets, plants more than 1 m tall, 11 March 1977, *C. Ochoa 11307* (OCH, CIP, MOL). Quipán, 3250 m alt., flowers blue, April 1978, *C. Ochoa and A. Salas 12579* (OCH). Quipán, 3250 m alt., April, 1978, *C. Ochoa and A. Salas 12580, 12581, 12582 and 12583* (all in OCH). Corocoro, 3250 m alt., near Quipán, flowers blue-light sky blue, April 1978, *C. Ochoa and A. Salas 12586* (CIP, OCH). Heading up from Antura to Huarhuaymarca, 2550-3000 m alt., 6 April 1979, *C. Ochoa and A. Salas 13259*, 2n=24 (CIP, OCH). Hualgacayán, 3300 m alt., heading down from Capra Cancha to Canta, flowers blue-sky blue, 3.5 cm in dia. with white acumens, pedicels articulated scarcely 3 mm below the calyx, May 1982, *C. Ochoa and A. Salas 14696* (OCH floral dissection only). Cancanpucro, 3800 m, heading up via the quebrada Chacayhuayque toward nearly the summit, District Lachaqui, plant robust flowers blue-sky blue, large, 4 cm in dia., tubers large strongly lenticulate, April 1982, *C. Ochoa 14714* (CIP, MOL, OCH, US). On the stream banks of the Arhua, 3300 m alt., between Quipán and Marco, along the route Huamantanga-Sumbilca, flowers sky-blue with white acumens, growing near other plants of the same species but with white flowers (*Ochoa 14717*), April 1982, *C. Ochoa 14718* (CIP, F, MOL, NY, OCH, US). Near Cerro de Quipán, 3400 m alt., between Huamantanga and Sumbilca, flowers pale bluish-white with a deep purple internal star, berries globose to long pyriform, persistent, light green almost white toward the apex, the rest much darker green with a few white dots, tubers large up to 10 cm long, ovoid, May 1982, *C. Ochoa and A. Salas 14719* (CIP, F, MOL, OCH, US, USM). Quebrada de Cororo, 3400 m alt., along the route Marco-Sumbilca, flowers sky-blue, 8 April 1983, *C. Ochoa and A. Salas 15143*, 2n=24 (CIP, F, MOL, NY, OCH, US). Quebrada de Cororo, 3400 m alt., along the route Marco-Sumbilca, flowers sky-blue, tubers large and ovoid or elongated, up to 6-7 cm long, 8 April 1983, *C. Ochoa and A. Salas 15144* 2n=24 (CIP, F, MOL, NY, OCH, US). Huamantanga, 11000 pies, "wild blue flowered," *McLean s.n.* (K type collection of *S. multiinterruptum*, GOET-drawing).

Province Huaral: Huallish, 3300 m alt., between Acos and Pacaraos, in rocky foothills among large boulders, berries globose, light green, densely spotted with white dots, flowers sky-blue, tubers ovoid, whitish-yellow, 5-6 cm long, 13 April 1982, *C. Ochoa 14688*, 2n=24 (CIP, OCH, US). Milacocha, 3400 m alt., above and northwest of Pacaraos, among shrubs of *Erodium cicutarium* and numerous colonies of *Cajophora* sp., flowers sky-blue, berries globose to ovoid, light green along the basal two-thirds of their length, almost white at apex, with sparsely distributed white dots,, 13 April 1982, *C. Ochoa 14689*, 2n=24 (CIP, OCH, UNTC, US), and *14690* (CIP, F, OCH, US). Along the route Acos-Pacaraos, 7 km before Pacaraos, 3200 m alt., berries and sky-blue flowers, 13 April 1982, *C. Ochoa 14691*, 2n=24 (CIP, OCH, US). Above Santa Cruz de Andamarca, 3700 m alt., about 3 km northeast of Pacaraos, in grasslands of a small quebrada, tubers large up to 9 cm long, stoutly ovoid, April 1982, *C. Ochoa 14693* (CIP, MOL, OCH, UNTC, US, USM). Above and near Santa Cruz de Andamarca, 3700 m alt., about 2.5 km northeast of Pacaraos, upper pedicels 6 mm long, berries ovoid to oval-pyriform, dark green, densely spotted with white dots in their basal third, light green almost white toward the apex, May 1982, *C. Ochoa 14694*, 2n=24 (CIP, OCH, US).

Province Huarochirí: Río Blanco, 3000-3500 m alt., open hillside, shrub, 2-4 ft., corolla blue, anthers white, 15-17 April 1929, *E.P. Killip and A.C. Smith 21757* (F, NY). Opico, ca. 9400 ft., 5 km above Huinco, on very rocky talus slopes of the mountain, plants up to 1.2 m alt., 28 February 1972, *Z. Huamán, J. Bryan, F. de la Puente and H. Ross 293-B* (CIP). Huinco-Oquibamba, ca. 11,100 ft., 8 miles past the town of Huinco, in rocky ground, plant large, tubers 20 g, 28 February 1972, *Z. Huamán, J. Bryan, F. de la Puente and H. Ross 294-B* (CIP, OCH). Tapiro, 3500 m alt., 10 km above Sheque, District Carampoma, on talus slopes of a rocky mountain, 25 April 1972, *C. Ochoa and J. Villarroel C. 3301* (OCH). 1/2 km above San Pedro de Casta, ca. 11.650 ft., flowers deep blue or light blue, among numerous weeds, 22 April 1972, *Z. Huamán, J. Bryan, F. de la Puente and H. Ross 310* (CIP) and *311* (CIP, OCH). Between Langas and Iscumarca, 3350 m alt., 15 April 1974, *C. Ochoa 5209* (OCH, Hb 1). Near Matarachi, 3650 m alt., before Iscumarca, heading up via the highway Lima-Huarochirí, 15 April 1974, *C. Ochoa 5214* (CIP, OCH), *5215* (CIP, OCH, US) and *5216* (OCH). Near Pachacosa, 3780 m alt., heading up via the highway Lima-Huarochirí, *puna*, among large rocks of the talus slopes along the road, 15 April 1974, *C. Ochoa 5219* (OCH). Between Iscumarca and Pachacosa, 3760 m alt., in a *puna* region but protected by large rocks and shrub thickets formed principally by *Barnadesia* sp., calceolarias and grasses, 15 April 1974, *C. Ochoa 5220* (CIP, OCH). San Lorenzo de Quinti, 2800 m alt., [April 1974 ?], *G. Vilcapoma 223* (CIP, OCH). Between Cumpe and Huinco, 3000 m alt., heading up to Huinco via the highway through the Quebrada de Santa Eulalia, March 1975, *C. Ochoa 7407* (OCH) and *7409* (CIP, NY, OCH, US). Above San Bartolomé, 2500 m alt., heading up via the pedestrian trail toward the forests of Zárate, March 1975, *C. Ochoa 7414* (OCH). Summit of Huachupampa, 3500 m alt., between Huinco and Huansa, heading up the highway of the Quebrada de Santa Eulalia, March 1975, *C. Ochoa and J.G. Hawkes 7438* (OCH). Near Seque, 3000-3200 m alt., heading up the highway of the Quebrada de Santa Eulalia toward Huinco and Huachupampa, among large stones and foothills of a mountain, March 1975, *C. Ochoa and J.G. Hawkes 7439 and 7440* (OCH). Near Huachupampa, 3450 m alt., between Huinco and Huansa, heading up the highway of the Quebrada de Santa Eulalia, in rocky foothills of a mountain, March 1975, *C. Ochoa and J.G. Hawkes 7441* (OCH). Between Huinco and Huachupampa, 3350 m alt., river above the Quebrada de Santa Eulalia, March 1975, *C. Ochoa and J.G. Hawkes 7442* (OCH). Gigantón, 2900 m alt., climbing by foot from San Bartolomé to Zárate, a little before Zárate or the Bosque de Zárate, n.v. *Papa de Gentil*, 16 March 1977, *C. Ochoa 11314*, 2n=24 (CIP, F, NY, OCH, US). Near Huachupampa, 3400 m alt., between Huinco and Huachupampa, heading up the highway of Santa Eulalia, plants very vigorous more than 1 m tall, among large rocks, 21 February 1978, *C. Ochoa 11879* (CIP, OCH, USM). Vicinity of the Seque dam, 3100-3200 m alt., near Huinco, along the route to Huachupampa, heading up via the Quebrada de Santa Eulalia, 21 February 1978, *C. Ochoa 11880*, 2n=24 (CIP, NY, OCH, US, USM), *11881* (CIP, OCH) and *11885* (OCH). Autisha, 2675 m alt., heading up via the Quebrada de Santa Eulalia to Huinco-Seque in the Unilateralion of Milloc, growing near *S. medians* and *S. wittmackii*, flowers bluish-lavender with whitish acumens, in rocky soil, 1 April 1979, *C. Ochoa 13269* (CIP, F, NY, OCH, UNTC). Between Caranaco and Huancamachay, 3425 m alt., near and above the Macachaca River, via Santa Eulalia-Marcapomacocha, growing with *Salpichroa, Echeveria* and some tufts of *Stipa* and small plants of *S. bukasovii*, flowers sky-blue, 11 April 1979, *C. Ochoa 13273* (CIP, OCH). Banks of the Rímac River, 3600 m alt., near the Chicla tunnel, heading up via the central highway Lima-La Oroya, between San Mateo and Chicla, February 1982, *C. Ochoa 14518* (OCH). Vicinity of the Seque dam, 3000-3100 m alt., near Huinco, heading up via the Quebrada de Santa Eulalia to Huinco and Huachupampa, on rocky slopes, flowers large, purple, February 1982, *C. Ochoa and M. Orrillo 14524* (CIP, OCH, US). Between large rocks, near Pacomanta, 3800 m alt., along the route Lima-Huarochirí, March 1982, *C. Ochoa 14614*, 2n=24 (CIP, F, NY, OCH, US). Talus slopes along the road between Huachupampa and Iris, 3000 m alt., growing near *Solanum hypacrarthrum*, flowers light purple, 30 March 1994, *L. Masson Meiss s.n.* (OCH). Highlands of San Juan de Iris, 3000 m alt., flowers violet, April 1994, *L. Masson Meiss and G. Yarú Paitán s.n.* (CIP, MOL, OCH, US, USM).

Province Yauyos: Cerro Shashaco, facing the town, 3100 m alt., 9 April 1960, *C. Ochoa 2292* (CIP, NY, OCH, US). Chijcha, 3200 m alt., District Piños, 15 March 1965, *C. Ochoa 2584* (OCH). Quichca, 3200 m alt., District

Vitis, 15 March 1965, C. *Ochoa 2585* (OCH). Auco, 2300 m alt., District Puente Alto, 15 March 1965, *C. Ochoa 2591* (OCH). Chápaca, 3400 m alt., near Yauyos, 15 March 1965, C. *Ochoa 2592* (OCH). Machacanizo, 3200 m alt., near Aquicha, east of Yauyos, 15 March 1965, C. *Ochoa 2593* (OCH). Aquicha, 3000 m alt., near Yauyos, 15 March 1965, *C. Ochoa 2594* (OCH). Huachipujio, 3000 m alt., near Aquicha, 15 March 1965, *C. Ochoa 2595* (OCH). Vicinity of Huamachaca, District Cocхарактеристики, 3200 m alt., 15 March 1965, *C. Ochoa 2600* (OCH). Quebrada de Malacanisho, 3350 m alt., near Pampas, 15 March 1965, *C. Ochoa 2602* (OCH). Above Callullo, 3200 m alt., near Pampas, 15 March 1965, *C. Ochoa 2605* (OCH). Pampas, 3000 m alt., near Yauyos, 15 March 1965, *C. Ochoa 2609* (OCH). Ijata Cacra, 3600 m alt., 18 May 1979, *D. Bauman s.n.* (OCH). Quinanchacra, 3000 m alt., above Tamará, District Omas, among large rocks, tubers large, ovoid to oval-flattened, 4-7 cm long, white, 5 April 1982, C. *Ochoa 14663* (CIP, OCH, UNTC, US, USM). District Huampará, Quisicaya, 3400 m alt., between three Cruces and Quinocay, associated with *Chuquiraga* sp. and grasses, in sandy-clay soil, April 1982, C. *Ochoa 14711* (CIP, OCH, US).

Putative Natural Hybrids of *Solanum multiinterruptum*

Although no special efforts were made by the author to locate hybrid populations of wild potato species in the field, these were sometimes encountered strictly by chance. The following four hybrids pertain to S. multiinterruptum:

Solanum multiinterruptum × *S. hypacrarthrum*

Plants of this parentage are small (20-30 cm tall), have poorly divided leaves, large ovate-lanceolate and strongly acuminate terminal leaflets, paniculate inflorescences and light blue flowers.

Department Ancash

Province Huaraz: Highlands of Huanchay, 3400 m alt., between Chamlla and Pampas, 7 June 1983, C. Ochoa, J. Espejo Ruiz and A. Salas 15255 (OCH).

Solanum multiinterruptum × *S. chomatophilum*

Plants of this parentage have a number of characteristics in common with S. chomatophilum, including habit, leaf shape and cylindrical stems that are pigmented and subglabrous. In many other respects, however, they are more like S. multiinterruptum, including calyx shape, floral pedicels that are articulated just beneath the base of the calyx cup, leaf segmentation, and leaflet size and shape. The very large corollas (4.0-4.5 cm in dia.) are especially like those of S. multiinterruptum.

Department Ancash

Province Huaraz: Chamlla, 3500 m alt., near Pampas, on very gently sloping hillsides, on moist rocky land, plants 1 m tall, stems strongly pigmented, nearly black, flowers sky-blue, large, 4 cm in dia., 9 June 1983, *J. Espejo Ruiz 001* (OCH).

Solanum multiinterruptum × *Solanum anamatophilum*

At the upper end of the Quebrada of La Fortress (Province Recuay, Ancash), almost at the top of the Conococha Pass, there occurs a small colony of wild hybrid potatoes. These plants resemble *S. multiinterruptum* in vigor, stem height (150 cm) and floral characteristics, but are more like *S. anamatophilum* in having leaflets that are narrowly elliptic-lanceolate and obtuse or slightly pointed at the tip, and broadly decurrent about the rachis at the base.

Department Ancash

Province Recuay: Heading up to the Conococha reservoir via the Quebrada de La fortress, 3850 m alt., on the gravel slopes of a mountain and among large rocks, flowers purple-lilac, large, 4 cm in dia., 6 May 1952, C. *Ochoa 1418* (OCH).

Solanum multiinterruptum × *S. medians var. autumnale*

These fairly tall plants (40-50 cm high) resemble *S. multiinterruptum* in having a cymose-paniculate inflorescence that bears large, light blue or sky-blue flowers (*ca.* 4.5 cm in dia.), pedicels articulated near the very base of the calyx cup and greatly divided leaves. However, the narrowly rhombic-lanceolate terminal leaflets and the conspicuously decurrent lateral leaflets of these hybrids are more like those of *S. medians* var. *autumnale*.

Because the lateral leaflets of these plants are very narrowly lanceolate or elliptic-lanceolate and the leaves are provided with numerous interjected leaflets of various size, it may be that there is a third species involved in this cross, possibly *S. wittmackii*.

Department Lima

Province Huarochirí: Llaquitambo, 3300 m alt., above Tupicocha, along the route San Damián, 21-24 April 1982, *C. Ochoa and A. Salas 14722*, 2n=24 (OCH).

Breeding Potential

The results of crosses of *S. multiinterruptum* with other diploid (2n=24) species of EBN=1 or EBN=2 and tetraploids (2n=48) of EBN=4 given in Table 90, while the materials used in these experiments are shown in Table 91.

From Table 90, we see that the reciprocal crosses of *S. multiinterruptum* with *S. chancayense* and *S. dolichocremastrum* yielded the highest average numbers of seeds per berry (117 and 190, respectively) for the seven EBN=1 plants that were tested. Successful results were also attained in reciprocal crosses involving *S. mochiquense* and *S. wittmackii*, but these gave only 68-94 seeds per berry on the average. However, only relatively few seeds were obtained in reciprocal crosses of *S. multiinterruptum* with *S. incahuasinum*. The latter is surprising in view of the fact that *S. incahuasinum* is closely related to *S. mochiquense* and *S. chancayense*, and these latter two species were much more compatible in crosses with *S. multiinterruptum*. A low degree of fertility was also observed in crosses of *S. multiinterruptum* with *S. hypacrarthrum*, but only when *S. multiinterruptum* was used as the staminate parent.

Table 90. Fertility of *Solanum multiinterruptum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	MEGISTACROLOBA	× *S. dolichocremastrum*	23(22)	14(17)	72(190)
24	1	PIURANA	× *S. hypacrarthrum*	11(19)	0(12)	0(8)
24	1	TUBEROSA	× *S. chancayense*	7(25)	6(9)	117(3)
			× *S. immite*	5(27)	0(21)	0(0)
			× *S. incahuasinum*	3(21)	1(15)	5(16)
			× *S. mochiquense*	13(19)	12(16)	94(68)
			× *S. wittmackii*	21(23)	12(18)	93(77)
24	2	CONICIBACCATA	× *S. chomatophilum*	10(27)	10(20)	0(31)
			× *S. limbaniense*	7(12)	2(6)	0(0)
24	2	CUNEOALATA	× *S. peloquinianum*	2	1	0
24	2	MEGISTACROLOBA	× *S. raphanifolium*	23(9)	19(7)	184(37)
			× *S. sogarandinum*	6(19)	1(11)	4(18)

24	2	PIURANA	× *S. chiquidenum*	19	7	0
24	2	TUBEROSA	× *S. bukasovii*	32(19)	12(15)	1(29)
			× *S. medians*-2x	22(47)	14(35)	131(28)
			× *S. medians*-3x	9(27)	0(13)	0(4)
			× *S. phureja*	18(3)	16(3)	0(3)
			× *S. sparsipilum*	14(10)	2(2)	0(0)
			× *S. tacnaense*	9(7)	1(5)	5(2)
48	4	TUBEROSA	× *S. tuberosum* subsp. *andigena*	3	3	40

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 91. Collections (OCH) used in *Solanum multiinterruptum* fertility studies.

CONICIBACCATA
S. chomatophilum 11856, 13201, 13208, 13234
S. limbaniense 14291

CUNEOALATA
S. peloquinianum 13230

MEGISTACROLOBA
S. dolichocremastrum 12071, 12072, 13013
S. raphanifolium 7619, 13625, 14298
S. sogarandinum 13006, 13293, 13324

PIURANA
S. chiquidenum 13963, 13965A
S. hypacrarthrum 11308, 11692, 13272

TUBEROSA
S. bukasovii 7820, 13195, 14333, 14407, 15202
S. chancayense 11250, 11765
S. immite 11689, 14491, 15184
S. incahuasinum 11613
S. medians-3x 13144, 14908
S. medians-2x 11259, 11637, 11638, 11882, 11889, 12044, 13140
S. mochiquense 14820, 15995
S. multiinterruptum 11314, 11690, 11693, 11694,11696, 11704, 11705, 11879, 11880, 11885, 12053, 12055, 12057, 12066, 13143, 13234, 13259, 14524, 14677, 14691, 14696, 14718, 15628
S. phureja 15071, 15325, 15326
S. sparsipilum 13697
S. tacnaense 11610, 11611
S. tuberosum subsp. *andigena* 5629
S. wittmackii 11029, 14626, 14674, 14677

With respect to the hybridization experiments involving diploid plants of EBN=2, a very large number of seeds were obtained in reciprocal crosses of *S. multiinterruptum* with *S. medians-2x* and *S. raphanifolium*, but only few seeds were obtained in crosses involving *S. tacnaense* and *S. sogarandinum*. Relatively few seeds were also obtained when *S. multiinterruptum* was used in reciprocal crosses with *S. bukasovii* and *S. chomatophilum*. Here again, seeds were obtained only when *S. multiinterruptum* was chosen as the staminate parent.

In the case of the reciprocal crosses involving *S. medians-3x*, only a few seeds were obtained and then only when *S. multiinterruptum* was used as the staminate parent. The low fertility observed in this cross, as opposed to that found in crosses involving diploid accessions of *S. medians*, is understandable in terms of the very low pollen fertility that is associated with triploid plants in general.

Lastly, those involved in the field of plant breeding will probably be interested in the fact that the three unilateral crosses involving *S. tuberosum* subsp. *andigena* were not only moderately successful, but turned out to be fairly easy to accomplish.

72a. ***Solanum multiinterruptum*** Bitt. var. ***machaytambinum*** Ochoa, Agronomía, Lima, 27(3):244-245, illustr., 1960. Fig. 362; Map 25.

Plant somewhat less pilose than the typical species. Leaflets elliptic-lanceolate, with pointed or apiculate apex, on petiolules 2-5 mm long; the first and second upper pairs nearly equal in size, the upper pair petiolulate, not decurrent on the rachis. Calyx little pilose, 10-11 mm long, the lobes elliptic-lanceolate, with linear-spatulate 4-5 mm long acumens. Pedicels articulated 5-8 mm below the calyx cup. Fruit ovate-conical to elongate-conical, yellowish-green, densely white-spotted.

Type: PERU. Department La Libertad, Province Otuzco, between Julcán and Machaytambo, 3000 m alt., 15 April 1959, *C. Ochoa 2164* (holotype OCH, isotypes MOL, US).

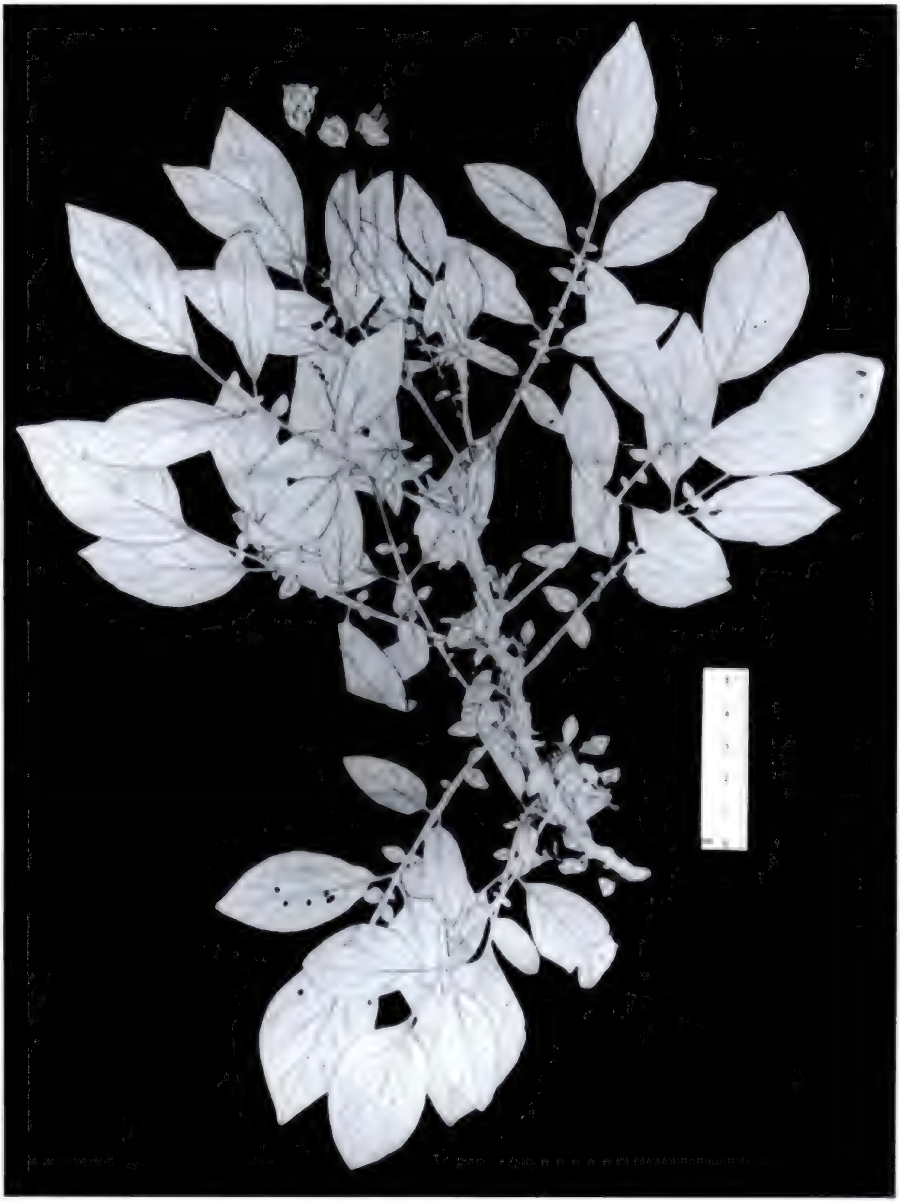


Figure 362. *Solanum multiinterruptum* var. *machaytambinum* (*Ochoa 2164*, isotype).

72b. *Solanum multiinterruptum* Bitt. f. *albiflorum* Ochoa forma nov.
Fig. 363; Map 25.

S. chrysoflorum Ochoa, Hickenia 1(59):317-320, illustr., 1982. Type: PERU, Department Lima, Province Canta, between Quipán and Marco, 3400 m alt., May 1982, *C. Ochoa and A. Salas 14716* (CIP, OCH, US).

Basically similar to the type species *S. multiinterruptum* in habit and pubescense. The main differences lie in its white-colored and larger flowers (4.5-5.5 cm in dia.), the lighter green or nearly yellowish-green leaves (these less divided than in the typical form), the more broadly elliptical and obtusely-tipped leaflets, and the smaller tubers, which are more globose to ovoid than in the typical form. Other characteristics of this form include pedicels that are articulated 5-7 mm beneath the calyx cup, a small 5-mm long subglabrous calyx with elliptical, apiculate or shortly acuminate lobes, and globose pure light green berries (not spotted).

The white or creamy-white flowers of the living plants of this form changes to yellow upon drying. Corollas bearing six lobes rather than the customary five are known.

Forma *albiflorum* is occasionally found growing with the typical blue or violet forms of S. multiinterruptum.

The habitat of this form at its type locality is undergoing rapid change due to the invasion of this area by colonies of *kikuyo*, or *Pennisetum clandestinum*.

Type: PERU. Department Lima, Province Canta, Quipán, 3250 m alt., 22 April 1978, *C. Ochoa and A. Salas 12584* (holotype OCH, isotype CIP).

Specimens Examined

Department Lima

Province Canta: Huamantanga, 11,000 ft alt., *McLean s.n.* "wild white flowered" (K). Lachaqui (Achoca), 3600 m alt., in moist soil, in shade of shrubby plants, among stones, flowers white, fruits dark green with light green apex, white-spotted, among white flowered *Calceolaria* sp., 18 May 1974, *G. Vilcapoma 231* (CIP, OCH, US). Quipán, 3250 m alt., flowers white, April 1978, *C. Ochoa and A. Salas 12584* (CIP, OCH, type collection of *S. multiinterruptum* f. *albiflorum*). Cororo, 3250 m alt., near Quipán, flowers white, April 1978, *C. Ochoa and A. Salas 12585* (CIP, OCH, USM). Banks of the stream, Chacayhuayque, 3500 m alt., heading up to Lachaqui, scarce, on sandy-clay slopes, flowers white to creamy-white with a lilac internal star, May 1982, *C. Ochoa and A. Salas*

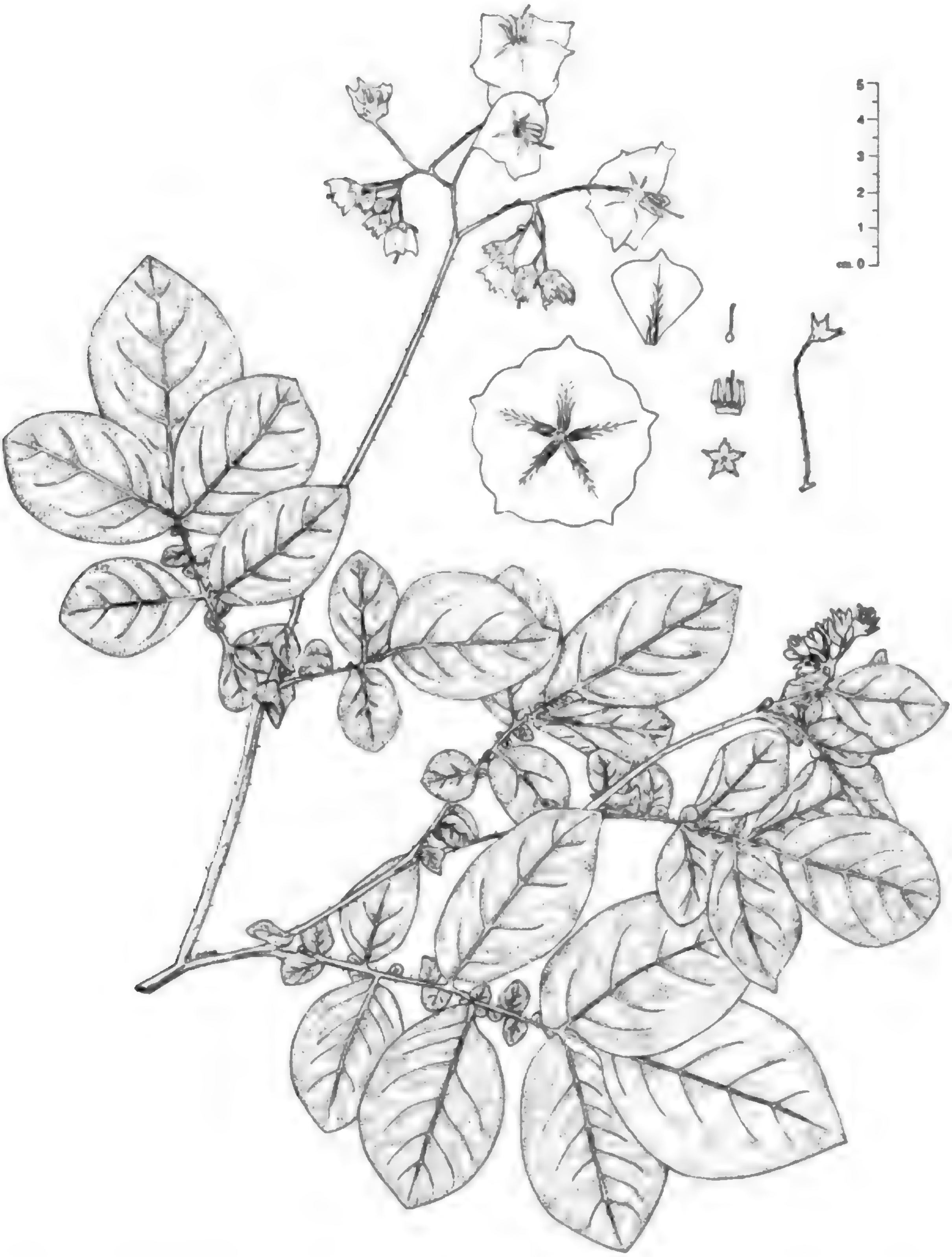


Figure 363. *Solanum multiinterruptum* f. *albiflorum* (*Ochoa and Salas 12584*, holotype).

14713 (CIP, MOL, OCH). Between Quipán and Marco, 3400 m alt., in a moist and cold quebrada among thicket shrubs, flowers creamy-white, May 1982, *C. Ochoa and A. Salas 14716*, 2n=24 (CIP, OCH, US, type collection of *S. chrysoflorum*). District of Huamantanga, Borders of the stream, Arhua, 3300 m alt., between Quipán and Marco, along the route Huamantanga-Sumbilca, flowers white, growing with other plants of the same species but with blue or sky blue flowers (*Ochoa 14718*), tubers large, ovoid or elongated, thick, 6-8 cm long, May 1982, *C. Ochoa and A. Salas 14717*, 2n=24 (CIP, MOL, OCH). Quebrada de Cororo, 3500 m alt., on rocky hillsides in thickets of composites, nettles and cylindrical cacti, flowers creamy-white, plants robust, leaves light green, berries globose, pure green without white dots, 8 April 1983, *C. Ochoa and A. Salas 15146*, 2n=24 (CIP, F, MOL, NY, OCH, US).

Province Huaral: Near Sumbilca, 3100 m alt., heading down towards Pacaybamba, pure white flowers, April 1978, *C. Ochoa and A. Salas 12587* (CIP, OCH, UNTC, USM).

Province Yauyos: District of Huampará, Quisicaya, 3400 m alt., between Tres Cruces and Quinocay, pedicels articulated 6-7 mm below the calyx (atypical of the species), flowers white, plant light green almost yellowish-green, tubers white, 3-4 cm long, round, not very lenticulate, growing in sandy-clay soil, associated with *Chuquiraga* sp. and grasses, April 1982, *C. Ochoa 14710* (OCH).

73. ***Solanum* × *neoweberbaueri*** Wittm., Engler. Bot. Jahrb. 50 (Suppl.):540-548, illustr., 1914. Figs. 364-365; Map 20.

S. medians f. *neoweberbaueri* (Wittm.) Corr., Wrightia 2:191, 1961.

Plant robust, (20-)35-50 cm tall, leafly; stem erect, simple or little-branched, (3-) 5-8 mm in dia. at base, light green, glabrescent, narrowly winged, stolons 50-90 cm or more long, white, thick and fleshy, 2-4 mm in dia.; tubers small, 1-2 cm long, round to ovoid, whitish-yellow. Leaves imparipinnate, light green, (7.0-) 12.5-16.5 cm long by (5.6-)9.0-12.0 cm wide, with 2-3 pairs of lateral leaflets and 0-1(-2) pairs of small, ovate and obtusely-tipped interjected leaflets, shortly pilose above and more densely pilose on the veins and veinlets below, rachis slightly winged; terminal leaflet broadly elliptic-lanceolate to ovate-lanceolate, slightly larger to much larger than the lateral leaflets, (3.5-)6.5-7.8 cm long by (2.2-)4.0-6.4 cm wide, lateral leaflets ovate-oblong, with pointed or shortly acuminate apices and rounded, sessile or subsessile bases, the first upper pair narrowly decurrent about the rachis; leaflet margins finely denticulate and pilose. Pseudostipular leaves broadly falcate, 10.0-12.0(-15.0) mm long by 7.0-9.0(-10.0)

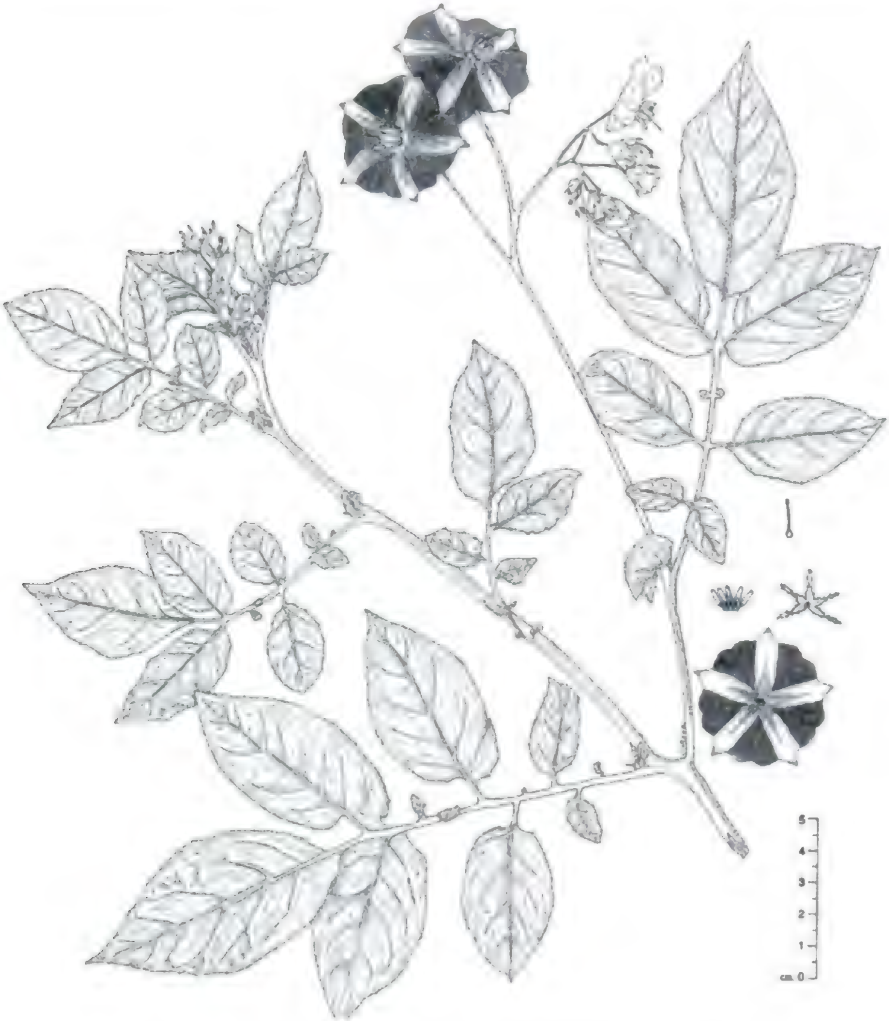


Figure 364. *Solanum* × *neoweberbaueri* (*Ochoa 11248*).

mm wide. Inflorescence lateral and terminal, dichotomous, (5-)12-18(-25)-flowered; peduncle (3-)5-12 cm long by 1.5-2.0 mm in dia. at the base, glabrous or sparsely pilose with short hairs; pedicels (1.5-)2.5-3.5(-4.0) cm long, glabrous or sparsely pilose, usually articulated 4-5 mm below the base of the calyx, or occasionally 10-12 mm below the base of the calyx. Calyx symmetrical, pilose, 7-10 mm long, lobes ovate-lanceolate, long-acuminate, acumens linear-spatulate, 3-6 mm long. Corolla rotate, large, 3-4 cm in dia., light-blue or pale blue-violet, with a longitudinal 5-6 mm wide white border that extends from the acumen to the base of each petal, this giving in conjunction with the corolla the appearance of a white star on a blue violet background; corolla acumens with very pointed apices, pilose along the margins, and, on the external side, pilose along the white border to near the calyx, which is covered with multicellular hairs. Anther column cylindric-conical; anthers narrowly-lanceolate, 5.5-6.0 mm long, on cordate bases; filaments 0.7-1.0 mm long, glabrous. Style 10 mm long, very slender, exerted 3-4 mm, densely papillose along the lower two-thirds of their length; stigma capitate, cleft, small, slightly enlarged at apex of the style. Chromosome Number: 2n=36.

Local Name: *Papa cimarrona* (=Wild Potato).

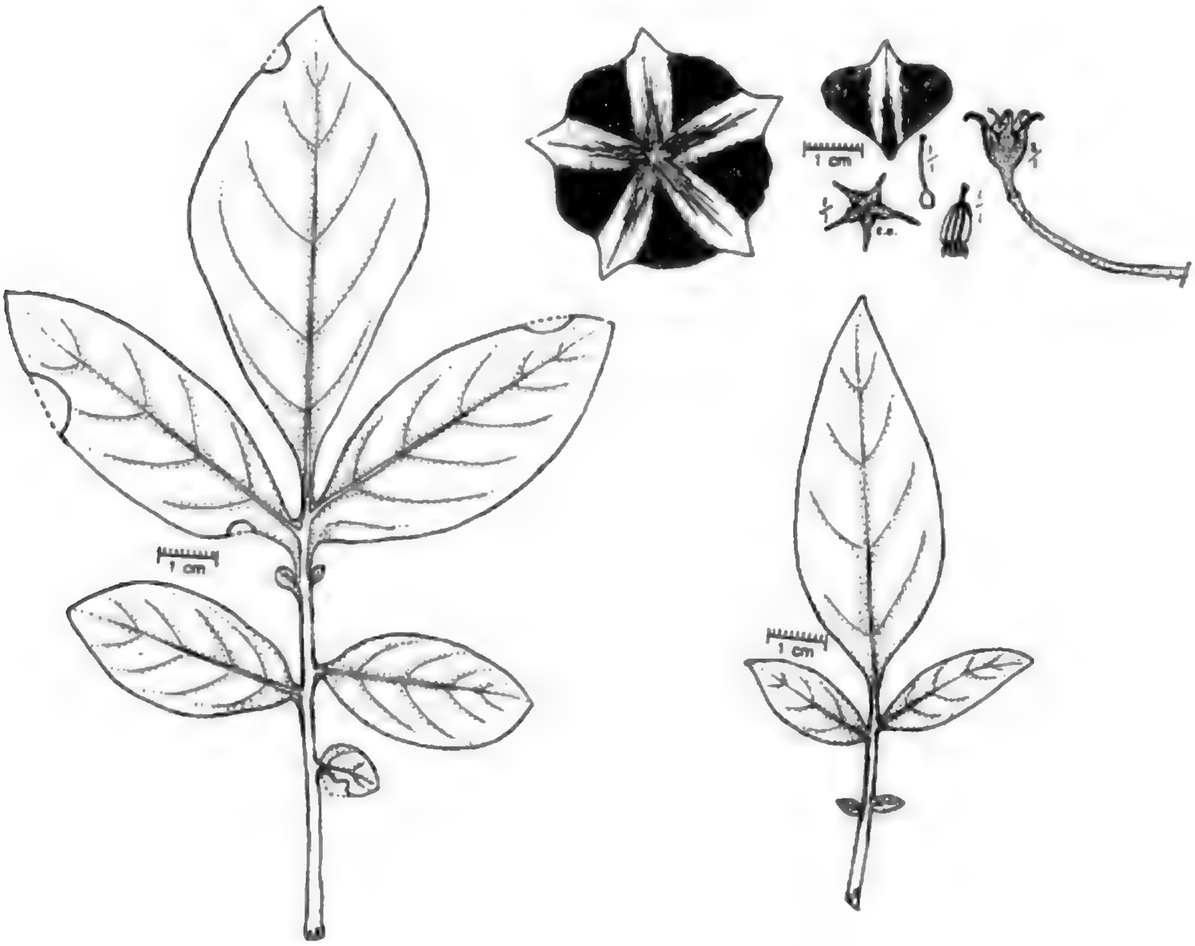


Figure 365. Leaf and floral dissection of *Solanum* × *neoweberbaueri*.

Type: PERU. Department and Province of Lima, Morro Solar, 250 m alt., near Chorrillos, in rocky places of a formation called *loma*, near sea level, 21 August 1910, *A. Weberbauer 5689* (F= lectotype, here designated, GH, GOET, US).

Although this wild potato is not known to set fruit under natural conditions, seedless globular berries 6-8 mm in diameter are occasionally formed in the greenhouse.

As reported in the literature, this species was first collected by John McLean at the *lomas* of Chorrillos. While the exact date of the collection is unknown, McLean lived and worked in Peru during the years 1832 to 1854.

The next known collection of this species was made by the distinguished Peruvian botanist Nicolás Esposto, a professor and one of the founders of the National School of Agriculture at La Molina, who in 1908 collected this wild potato at Mt. Morro Solar near Chorillos. Today, the institution he helped found is known as the National Agrarian University at La Molina (MOL).

Nicolás Esposto published a catalog of the plant collections found in his institution's herbarium in the year 1913 (see *Memoria Anual de la Sección de Botánica Aplicada de la Central Agronónica de Santa Beatriz, Lima*, published by the *Dirección de Fomento*, Appendix III). On page 31 of this work we see the following citation: "*Solanum tuberosum* L. collected in the *loma* of Chorillos in September of 1908." The potato that is referred to in Esposto's work is actually the same one that was collected by him at Chorillos, and which corresponds to *S.* × *neoweberbaueri* in the present work. However, at the time of Esposto's collection, the present name for this wild potato had not yet been published in the literature. This was done in 1914 by Wittmack, who based the name of his new species on a collection by Weberbauer (*No. 5689*).

From Esposto's herbarium collections at La Molina (MOL), we know that he collected *S.* × *neoweberbaueri* on Mt. Morro Solar on at least four other occasions, including July 1912, July 1920 and twice on November 11, 1937. Unfortunately, beginning in the early 1940's, *S.* × *neoweberbaueri* began to gradually disappear from Mt. Morro Solar and its surroundings and today has become totally extinct from this locality.

Affinities

Plants of *Solanum* × *neoweberbaueri* may be easily confused with *S. medians*. Both have very similar-appearing leaves, calyces and flowering pedicels. However, the two are readily differentiated from one another on the basis of corolla size and color, the density of the pilosity of the plant, and by the fact that *S.* × *neoweberbaueri* fails to set berries.

In so far as the origin of this triploid hybrid potato is concerned, *S.* × *neoweberbaueri* appears to have arisen in natural crosses between two wild diploid potatoes of the coastal loma formations, *S. medians* (with the participation of an unreduced gamete) and *S. chancayense*. Artificial crosses made between these two species at CIP utilizing *S. chancayense* as a pollen source yielded plants that were remarkably similar in morphology to *S.* × *neoweberbaueri*. The F_1 plants of this cross resembled *S.* × *neoweberbaueri* in habit, leaf shape and segmentation and in the pilosity of the calyx, but were smaller in size and had white flowers (similar in color to those of *S. chancayense*) with either very short acumens or long subspatulate ones. However, plants very similar to *S.* × *neoweberbaueri* appeared in the F_2 population, including segregate types having the characteristic color patterning of the corolla, whereby the white borders of the petals appears as a brilliant star on a background of pale blue-violet.

Habitat and Distribution

Solanum × *weberbaueri* is known only from the *loma* formations and *colinas* (or low hills) of the desert coast of Peru. In the *lomas*, the growing season occurs during the winter months and is stimulated by the meager moisture that is carried inwards from the ocean by the periodic fogs or mists (*garúas*). Within these areas of vegetation, *S.* × *weberbaueri* grows in poor, sandy, or sandy-rocky soil, or between rock crevices as in the case of the *lomas* at Manzano and Atosisa, near Pachacamac.

Geographically, this species is restricted to the low hills and loma formations that occur near Lima, Department of Lima, where it grows at elevations between 200 and 700 m (Map 20).

Specimens Examined

Department Lima

Province Cañete: *Lomas* of Quilmana, 200-250 m alt., between Lima and Cañete, *loma* formation, rocky, scarce, flowers violet, 3 September 1950, *R. Ferreyra 8022* (LL, USM). *Lomas* of Quilmana, 350 m alt., about 10 km north of Cañete, in sandy soil associated with *Calceolaria*, *Oxalidaceas*, *Urticaceas*, and other non-tuberous *Solanums*, corolla lilac with star white, 23 October 1976, *C. Ochoa and A. Salas 11252*, 2n=36 (CIP, GH, MOL, OCH, USM, US) and *11253*, 2n=36 (CIP, OCH, US). *Lomas*, near the Condestable Mine, 600 m alt., 5 km east of Bujama Baja, between Mala and Asia, south of Lima, October 1976, *C. Ochoa 11272*, 2n=36 (CIP, GH, MOL, OCH, US) and *11273*, 2n=36 (CIP, F, GH, MOL, NY, OCH, UNTC, USM, US). Condestable Mine, 550 m alt., 7 km south-southeast of Mala, in *loma* formations, flowers light violet with white star in the petals, October-November 1976, *C. Ochoa 11274*, 2n=36 (OCH).

Province Lima: From hills at Chorrillos, 1832-1854, *J. McLean s.n.* (K). Sandy hills of Lima, common, 1862, *W. Nation s.n.* (K). *Lomas* of Chorrillos, September 1908, *N. Esposto s.n.* (MOL). Morro Solar near Chorrillos, *loma* formation, 250 m alt., 21 August 1910, *A. Weberbauer 5689* (B destroyed, F, GH lectotype, here designated, GOET, US, type collection of *S. neoweberbaueri*). Chorillos [Lima], among rocks of the Morro Solar, July 1912, *N. Esposto s.n.* (MOL, OCH-fragment). Morro Solar of Chorrillos, [Lima], herb, flowers blue or sky blue with 5 white rays, 11 September 1937, *N. Esposto s.n.* (MOL). Cerros de Amancaes, in rocky ground (*lomas*), 12 July 1920, *N. Esposto s.n.* (MOL, USM). Chorrillos [Lima], near the crest of Morro Solar, in rocky ground, 11 November 1937, *N. Esposto s.n.* (MOL, OCH). *Lomas* of Manzano, 200-300 m alt., near the town of Pachacamac, south-southeast of Lima, on the steep slope of a rocky mountain, 25 October 1958, *C. Ochoa 1807*, 2n=36 (CIP, GH, OCH, US), *1808* (CIP, GH, OCH, US) and *2163*, 2n=36 (OCH, US). *Lomas* of Atosisa, near entrance to Atosisa, 300 m alt., 35 km south-southeast of Lima and east of the town of Pachacamac, in sandy-rocky soils, among many plants of *Hymenocallis amancae*, n.v. *Papa Cimarrona*, 21 July 1971, *C. Ochoa 3035* (OCH, US). *Lomas* in the vicinity of Cerro Zárate, 400 m alt., Hacienda Zárate, near Lima, September 1972, *C. Ochoa 3656*, 2n=36 (MOL, OCH, plants grown at the Esc. Nac. de Agr., La Molina, Lima, from the original tubers). *Lomas* of Caringa east of San Bartolo, 350 m alt., 10 km east of San Bartolo, entrance at km 58 of the south Panamerican Highway, among stones, 21 October 1976, *C. Ochoa* and *A. Salas 11248*, 2n=36 (CIP, GH, MOL, OCH, UNTC, USM, US, plants propagated in a field at Huancayo from the original tubers), and September 1978, *C. Ochoa 13033*, 2n=36 (OCH, from plants propagated at La Molina, Lima). *Lomas*, near Huarochirí Mine, 750 m alt., at km 5 entering by the town of Lurín, toward the east, in sandy-rocky ground, south of Lima, 22 October 1982, *C. Ochoa 14860*, 2n=36 (CIP, OCH, US).

Breeding Potential

The results of crosses of *S.* × *neoweberbaueri* (2n=36) with diploid species (2n=24) of EBN=1 and EBN=2 are given in Table 92, while the materials used in these experiments are shown in Table 93.

As explained earlier, *S.* × *neoweberbaueri* is a naturally occurring triploid hybrid and is essentially self-sterile. However, as some clones produce a small amount of viable pollen, this wild potato was used experimentally in a number of crosses.

Unfortunately, no success was attained in unilateral crosses of *S.* × *neoweberbaueri* with *S. jalcae*, *S. medians*, *S. multiinterruptum*, *S. goniocalyx* or *S. phureja*. Nor were seeds obtained in reciprocal crosses of this plant with *S. chomatophilum*, *S. huarochiriense* or *S. mochiquense*. However, as unilateral crosses with *S. bukasovii*, *S. megistacrolobum* and *S. sogarandinum* resulted in the production of a small numbers of seeds, such results may signify the possible future importance of this plant in breeding programs.

Table 92. Fertility of *Solanum* × *neoweberbaueri* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	TUBEROSA	× *S. mochiquense*	8(7)	0(1)	0(0)
24	2	CONICIBACCATA	× *S. chomatophilum*	9(3)	4(1)	0(0)
24	2	INGAEFOLIA	× *S. jalcae*	13	4	0
24	2	MEGISTACROLOBA	× *S. megistacrolobum*	5	2	4
			× *S. sogarandinum*	11	6	2
24	2	TUBEROSA	× *S. bukasovii*	12	9	22
			× *S. goniocalyx*	24	18	0
			× *S. huarochiriense*	11(4)	5(1)	0(0)
			× *S. medians*-2x	13	18	0
			× *S. multiinterruptum*	10	9	0
			× *S. phureja*	46	32	0

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 93. Collections (OCH) used in *Solanum* × *neoweberbaueri* fertility studies.

CONICIBACCATA
S. chomatophilum 11856, 13208

INGAEFOLIA
S. jalcae 14490

MEGISTACROLOBA
S. megistacrolobum 14272
S. sogarandinum 13006

TUBEROSA
S. bukasovii 13124, 15202
S. goniocalyx 00001
S. huarochiriense 11331, 14525
S. medians-2x 11637
S. mochiquense 14820
S. multiinterruptum 14718
S. phureja , 13130, 15072, 15130, 15131, 15137, 15326
S. × *neoweberbaueri* 11272, 11273, 11274, 14860

74. *Solanum orophilum* Corr., Wrightia 2:192, 1961.

Figs. 366-370; Map 21.

Plant robust, erect-ascending, 70-150(-200) cm tall, sparsely pilose and somewhat glandular; stem vigorous, 1.5-2.0 cm in dia. at base, simple or branched, subglabrous, light green or irregularly spotted or pigmented purple-violet in the basal one-third of its length, wings narrow or broad, straight, internodes (5-)7-14 cm long. Stolons very long, 1.50-2.50 m, thick and fleshy, 4-8 mm in dia., bearing single or occasionally moniliform tubers, round to ovoid, white very lenticulate, large, (4-)8-10 cm long or when moniliform, smaller, and 1.5-2.0 cm long, eyes deep to semi-deep. Leaves (13.0-)17.0-27.5(-36.0) cm long by (8.0-)12.5-14.5(-18.0) cm wide, sparsely pilose above and densely puberulent on the rachis, veins, veinlets and mesophyll below, imparipinnate, with 4-5 pairs of lateral leaflets and 5-12 pairs of interjected leaflets, these of different size. Lateral leaflets elliptic-lanceolate, rarely elliptic or narrowly elliptic-lanceolate, with pointed or abruptly acuminate apices and oblique bases, broadly rounded to subcordate, sessile or shortly petiolulate. Terminal leaflet frequently rhombic-lanceolate, slightly larger than the laterals, 4.5-7.0(-11.5) cm long by 2.4-2.8(-4.6) cm wide; the first pair of lateral leaflets 4.0-6.0(-9.5) cm long by 1.7-2.4(-3.5) cm wide. Interjected leaflets suborbicular or elliptic to ovate-elliptic, small, 1.5-7.0 mm long, sessile. Pseudostipular leaves semiovate or broadly falcate, 7-18 mm long by 4-9 mm wide. Inflorescence cymose-paniculate, terminal and lateral, very floriferous, 15-25-flowered; peduncle vigorous, 9-14(-20) cm long by 2-3 mm in dia. at the base, bifurcate or trifurcate, densely pilose, with the longer hairs mixed with very short glandular hairs; pedicels 15-25(-30) mm long, glandular-pubescent as in the case of the calyx, articulated above center or approximately 7-9 mm below the base of the calyx. Calyx symmetrical or asymmetrical, slightly pigmented, 8-10 mm long; lobes ovate-subcuadrate, abruptly narrowed to very long narrow acumens or linear and pointed, about 4-6 mm long. Corolla light blue-violet or pale blue-lilac, rotate, 5-6-lobed, 3.0-3.5 cm in dia. Anthers lanceolate, 6-7 mm long; filaments 1-2 mm long or less, glabrous. Style 10.0-11.5 mm long, exerted 3.0-3.5 mm, densely papillose along the lower two-thirds of its length; stigma capitate. Fruit subglobose to ovoid, 2.0-2.5 cm long, green with a few vertical pale violet stripes and lightly white spotted. Chromosome Number: 2n=24. EBN=2.

Local Names: At various localities in the Department of Ancash the plant the plant is referred to as *Papa de Zorro* (or Fox Potato), while the fruit is known as *Coilochumpa*.

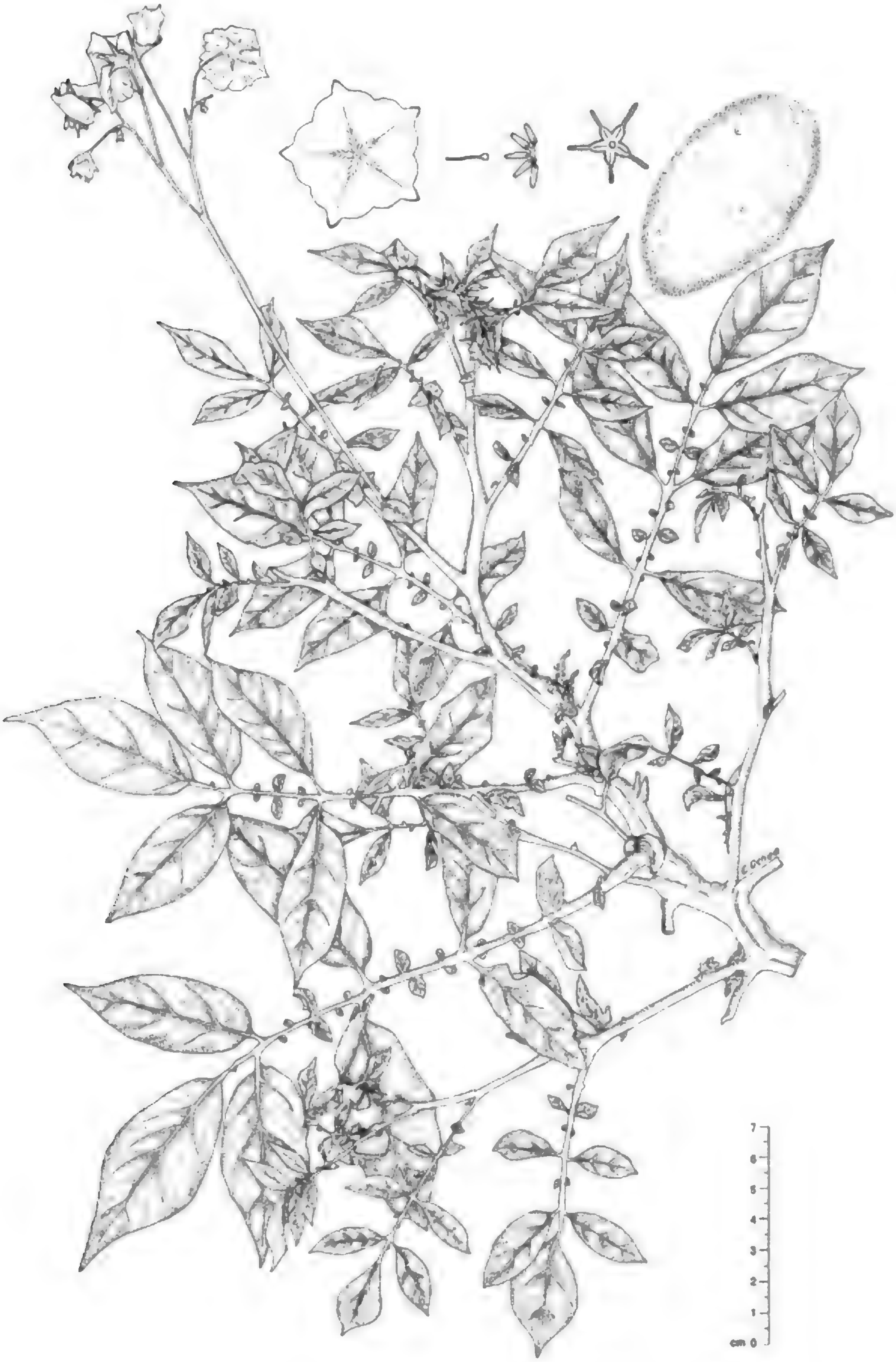


Figure 366. *Solanum orophilum* (*Ochoa 13023*).

Type: PERU. Department Ancash, Province Chavín, several km above Chavín, 3500 m alt., on rocky-shrubby slopes, 30 March 1960, *D.S. Correll and E.E. Smith 971* (US, lectotype, here designated, K, LL, S, isolectotypes).

Affinities

This species is related to *S. ambosinum*. The two are similar in habit, vigor, pubescence and leaf dissection, and both have a tendency to produce large tubers. Moreover, *S. orophilum* is very compatible with *S. ambosinum* in reciprocal crosses. However, *S. orophilum* differs markedly from *S. ambosinum* in several important respects, including in the point of placement of its pedicel articulation, the density of its indumentum, the shorter and finer pubescence of its leaves, its narrow, acuminately-tipped elliptic-lanceolate leaflets, its symmetrical or asymmetrical calyx with long acuminate and filiform lobes, and in its smaller, more varied-colored corolla.

Habitat and Distribution

Solanum orophilum grows among large boulders on rocky hillsides and in moist sandy-clay soils in quebradas, where it occurs in thickets of herbs and shrubs. In various parts of its range it is associated with *Mutisia*, *Monnina*, *Cantua*, *Lupinus*, grasses and various species of composites, such as *Chaptalia*, *Onoseris*, *Trichocline*. It has also been collected from moist slopes, spring borders and the margins of forest stands of *Alnus* and *Buddleja*.

Although this species spans a fairly broad altitudinal range, occurring from 4000 m altitude down to 2700 m, it prefers the cooler, middle to upper altitudes, where it may be found frequenting quebradas and *prepuna* lands. Of the 44 collections of this species that were included in this study, 36 came from localities that were situated between 3000 and 3750 m altitude.

Presently, this species is known only from the Departments of Huánuco, Ancash and La Libertad in northern Peru (Map 21).

Specimens Examined

Department Ancash

Province Antonio Raymondi: Cuncayocc, 3850 m alt., near Yurac Yacu, among large rocks and on stony hillsides, tubers ovoid to long compressed 6-8 cm long, 20 April 1978, C. *Ochoa 12077*, 2n=24 (CIP, F, GH, MOL, OCH, US) and *12078*, 2n=24 (CIP, MOL, OCH, US, UNTC, USM). Peña Lilia, 3100 m alt., near Uchupata, 20 April 1978, *C. Ochoa 12079*, 2n=24 (CIP, MOL, OCH, USM, US).

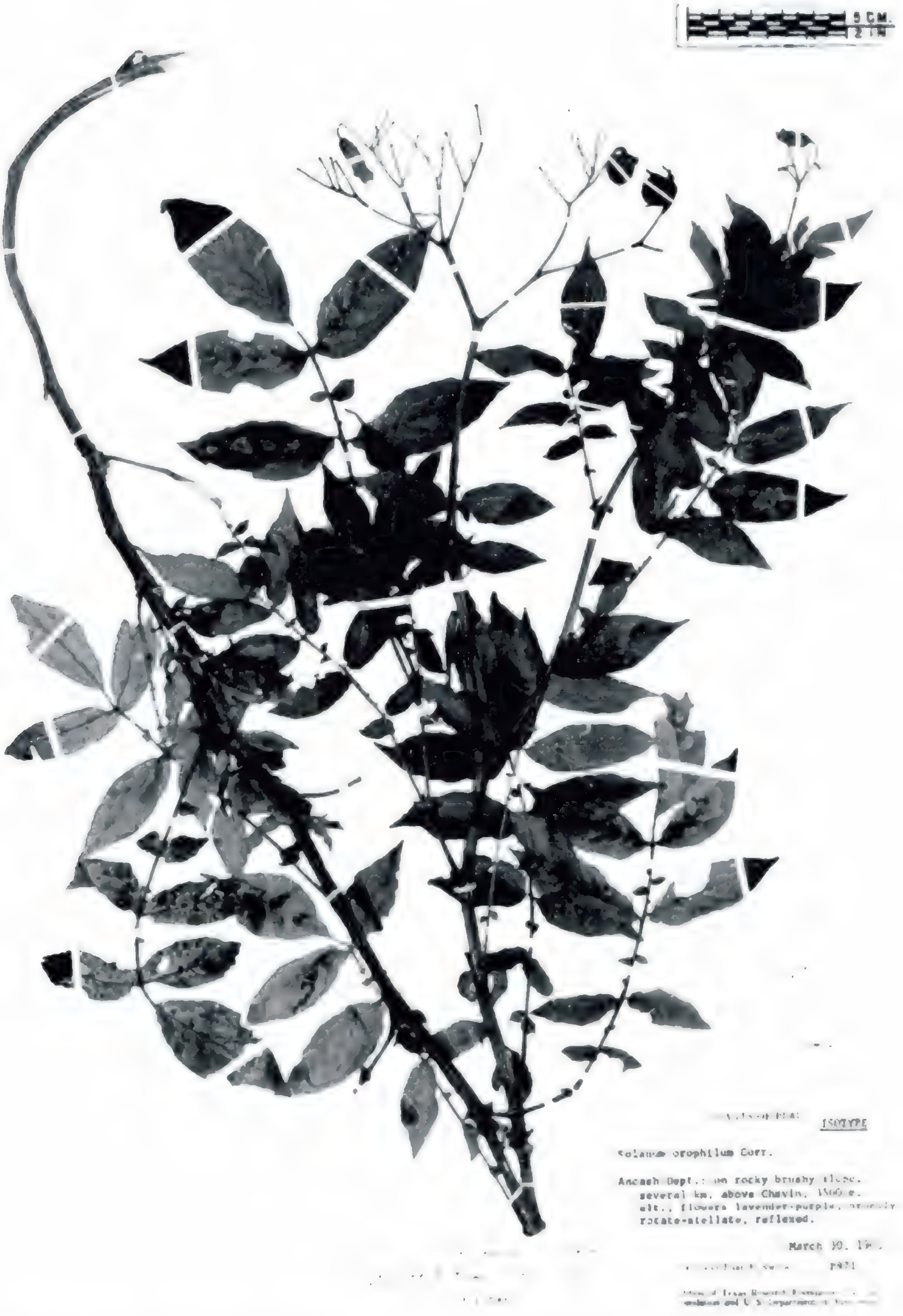

5 CM.
2 IN
ISOTYPE
Solanum orophilum Corr.
Ancash Dept.: on rocky brushy slope,
several km. above Chavin,
alt., flowers lavender-purple,
rotate-stellate, reflexed.
March 30,
P971

Figure 367. *Solanum orophilum* (*Correll and Smith P971*, lectotype). Photo: Courtesy of the Department of Botany at the Smithsonian Institution (US).

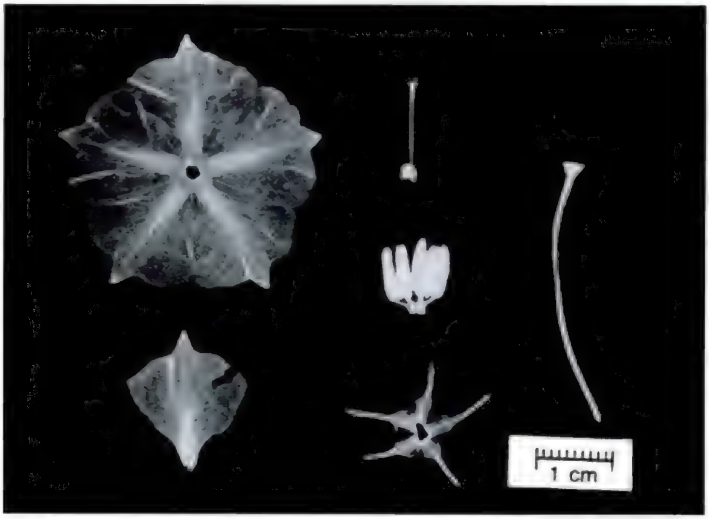


Figure 368. Floral dissection of *Solanum orophilum* (*Ochoa 13023*).

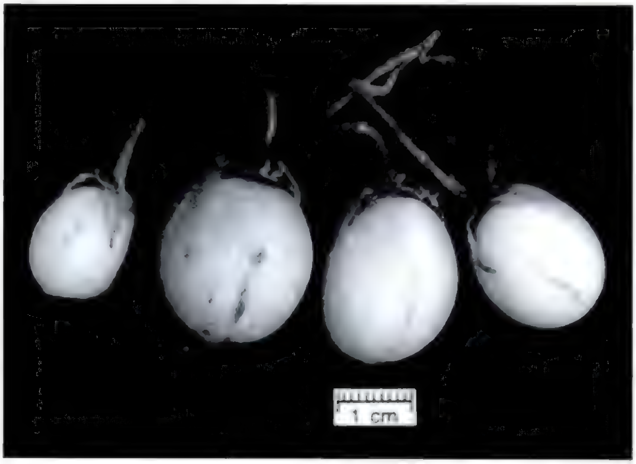


Figure 369. Fruits of *Solanum orophilum* (*Ochoa 13003*).

Province Asunción (formerly Carhuaz): Ismurumi, 3600 m alt., in moist soil on mountain slopes and margins of an *aliso* (*Alnus* sp.) forest, 5 April 1995, *C. Ochoa and A. Salas 16213* (CIP, OCH, plants propagated in a glass box at Huancayo).

Province Corongo: District Yanac, Murosh, 2800 m alt., along the route from Yurac Marca, heading up to Sihuas, 3-6 May 1978, *C. Ochoa 13003* (CIP, MOL, OCH, USM).

Province Huari: District San Marcos, Huari, 3800 m alt., plants very vigorous up to 2 m tall, flowers blue, 20 February 1960, *C. Ochoa 2273* (OCH). San Luis, 2800 m alt., plants to 2 m tall, flowers blue, 20 February 1960, *C. Ochoa 2274* (OCH) and *2275* (MOL, OCH). Highlands of San Luis, 4000 m alt., plants 50 cm tall, flowers blue, 20 February 1960, *C. Ochoa 2277* (MOL, OCH, USM, US). Vicinity of San Marcos, 2800 m alt., flowers sky-blue, plants 80 cm tall, February 1960, *C. Ochoa 2278* (CIP, OCH). On rocky brushy slope, several km above Chavín, 3500 m alt., flowers lavender-purple, broadly rotate-stellate, reflexed. March 30, 1960; *D.S. Correll and E.E. Smith P971* (LL, S, US). Acopalca, 3200 m alt., 25 km from Huari going toward San Luis, fruits round, 2.0-2.5 cm in dia., pure light green, 16 April 1978, *C. Ochoa 12080*, 2n=24 (CIP, F, GH, MOL, OCH, USM, US). Segundo Rag Rag, 3500 m alt., further above Acopalca, about 35 km from Huari, along the route to San Luis, 16 April 1978, *C. Ochoa 12082*, 2n=24 (CIP, OCH, US). San Luis, 3200 m alt., tubers ovoid, large, 7-8 cm long, berries round, pure light green, 20-25 mm in dia., 10 May 1978, *C. Ochoa 13011*, 2n=24 (CIP, MOL, OCH, USM from plants propagated in the greenhouse at Huancayo). Some 6-10 km from Chavín, 3500 m alt., Col. Ministerio de Agricultura and Pesquería (Lima, Peru), Herbario Papa *s.n.*, 28 February 1969 (CIP, 2-sheets).

Province Huaylas: Vicinity of Pasacancha, 3350 m alt., only tubers were collected, May 1972, *C. Ochoa 3643* (CIP, MOL, OCH, USM, US from plants reproduced from tubers at the Granja K'ayra, Cusco, 3250 m alt., in December 1972). Cashapampa, 3825 m alt., near the reservoir, vicinity of Huaripampa, 12-16 May 1978, *C. Ochoa 13016* (CIP, OCH).

Province Pallasca: Facing Conchucos, 3650 m alt., among thicket shrubs and dried plants, 4 June 1963, *C. Ochoa 2533* (OCH). Yanacocha, 3600 m alt., along the route Conchucos-Yanacocha, among weeds, 6 June 1963, *C. Ochoa 2540* (OCH). Facing Conzuso, 3600 m alt., near the Huara Mines, 10 June 1963, *C. Ochoa 2548* (CIP, OCH). Between Conzuso and Chulén, 3450 m alt., plants vigorous, 80 cm tall, flowers violet, on moist loose ground, in a moist quebrada in vegetation dominated by *Stipa* sp., 26 March 1964, *C. Ochoa 2561*, 2n=24 (OCH). Chulén, 3400 m alt., near Conzuso, 26 March 1964, *C. Ochoa* *and J.G. Hawkes 2563* (MOL, OCH). Yanacocha, near Conchucos, 26 March 1964, *C. Ochoa 2681* (OCH, plants propagated from seed at the Univ. Nac. Agrar. La Molina, Lima, in October 1964).

Province Pomabamba: Sihuas, 3350 m alt., near Paccha, 2 June 1963, *C. Ochoa 2526* (GH, OCH, US, plants propagated at the Univ. Nac. Agrar. La Molina, Lima, in December 1963).

Province Recuay: Cerro Bronce, 3100 m alt., between Ocros and Succha, 17 April 1963, *C. Ochoa 2497* (CIP, F, GH, MOL, NY, OCH, UNTC, USM, US). Irmac, 3200 m alt., road to Chavín, above the Hacienda Cocho, 17 April 1963, *C. Ochoa 2498* (F, GH, MOL, OCH, USM, US).

Province Sihuas: Huinshica, 3200 m alt., near Huayllabamba, 7 May 1978, *C. Ochoa 13007*, 2n=24 (OCH, US). Heading down towards Cashapampa, near the Quebrada de Santa Cruz, 3400-3500 m alt., berries globose, light green with vertical purple stripes, 12-16 May 1978, *C. Ochoa 13020*, 2n=24 (CIP, MOL, OCH).

Province Yungay: Maria Huayta or Maria Monte, near Colcabamba, 3750 m alt., tubers whitish-yellow, long pyriform, subcylindrical, ovoid to oval flattened,12-16 June 1978, *C. Ochoa 13015*, 2n=24 (CIP, F, GH, NY, OCH, US). Vicinity of Jacabamba, 3400 m alt., on rocky hillsides, in shrubby thickets, 22 December 1978, *C. Ochoa 13021*, 2n=24 (CIP, MOL, OCH, US, USM). Jaillac, 3500 m alt., principal place of access to the quebradas of Ulta and Shanoc, near the main irrigation canal of the communities of Mashco and Chalhua, in forests of *Alnus* sp., 23 December 1978, *C. Ochoa 13022,* 2n=24 (CIP, GH, OCH, US). Chincuil, 3700 m alt., along the route from Yurma to Culluna, abundant globose berries typical of *S. orophilum*, 25 December 1978, *C. Ochoa 13023*, 2n=24 (CIP, GH, MOL, OCH, UNTC, US, USM). Colcabamba, 77° 32' W, 9° 00' S, 3600-3790 m alt., arid shrubland, altered by grazing and agriculture, steep slopes, flowers pale violet, 10 January 1985, *D. N. Smith 9029* (MO).

Department Huánuco

Province Huamalíes: Casacancha, 3200 m alt., near Urpish, May 1972, *C. Ochoa 3655* (OCH, plants propagated from the original seed at the Univ. Nac. Agrar. La Molina, Lima, in May 1973).

Department La Libertad

Province Pataz: Tororagra, 3200 m alt., 11 March 1971, *C. Ochoa 2955* (MOL, OCH, UNTC, USM). Quinuapuquio, 3200 m alt., only tubers were collected, June 1971, *C. Ochoa 3046* (OCH, plants propagated from the original tubers at the Univ. Nac. Agrar. La Molina, Lima, in November 1971). District Tayabamba, Ucrumarca, 2800 m alt., 13 February 1973, *C. Ochoa 3598* (OCH). District Tayabamba, Río Cajón, 3250 m alt., 14 February 1973, C. *Ochoa 3599* (OCH). District Tayabamba, Huanchil, 3250 m alt., growing with *Rubus*, 16 February 1973, *C. Ochoa 3603* (OCH). Vicinity of Huancaspata, 3000 m alt., 17 February 1973, C. *Ochoa 3604* (OCH). Near Tayabamba, 3200 m alt., April 1973, *Ochoa s.n.* (= *PI-458405*). Vicinity of Tayabamba, 3250 m alt., 1973, *J. Lecca s.n.* (OCH) and (OCH, plants propagated from the original tubers at La Molina, Lima, in November 1973). Chiguil, near Tayabamba, 3350 m alt., scarce, 26 December 1978, C. *Ochoa 13024*, 2n=24 (CIP, GH, MOL, OCH, UNTC, US, USM). Muriaco, 3150 m alt., near Huancaspata, plants without flowers in full fruit, 6 May 1979, C. *Ochoa 13318*, 2n=24 (CIP, OCH, US). Santa Maria, 2700 m alt., near Urpay, 7 May 1979, *C. Ochoa 13321* (CIP, OCH). Granero, *ca.* 3000 m alt., between Urpay and Taurija, plants up to 1.5 m or more tall, tubers large, 8-10 cm long, 7 May 1979, C. *Ochoa 13322*, 2n=24 (CIP, OCH, US). Highlands of Cedro, *ca.* 3000 m alt., near Granero, along the route Urpay-Taurija, only tubers were collected, they are large, 7-9 cm long, 7 May 1979, C. *Ochoa 13323*, 2n=24 (CIP, MOL, OCH).

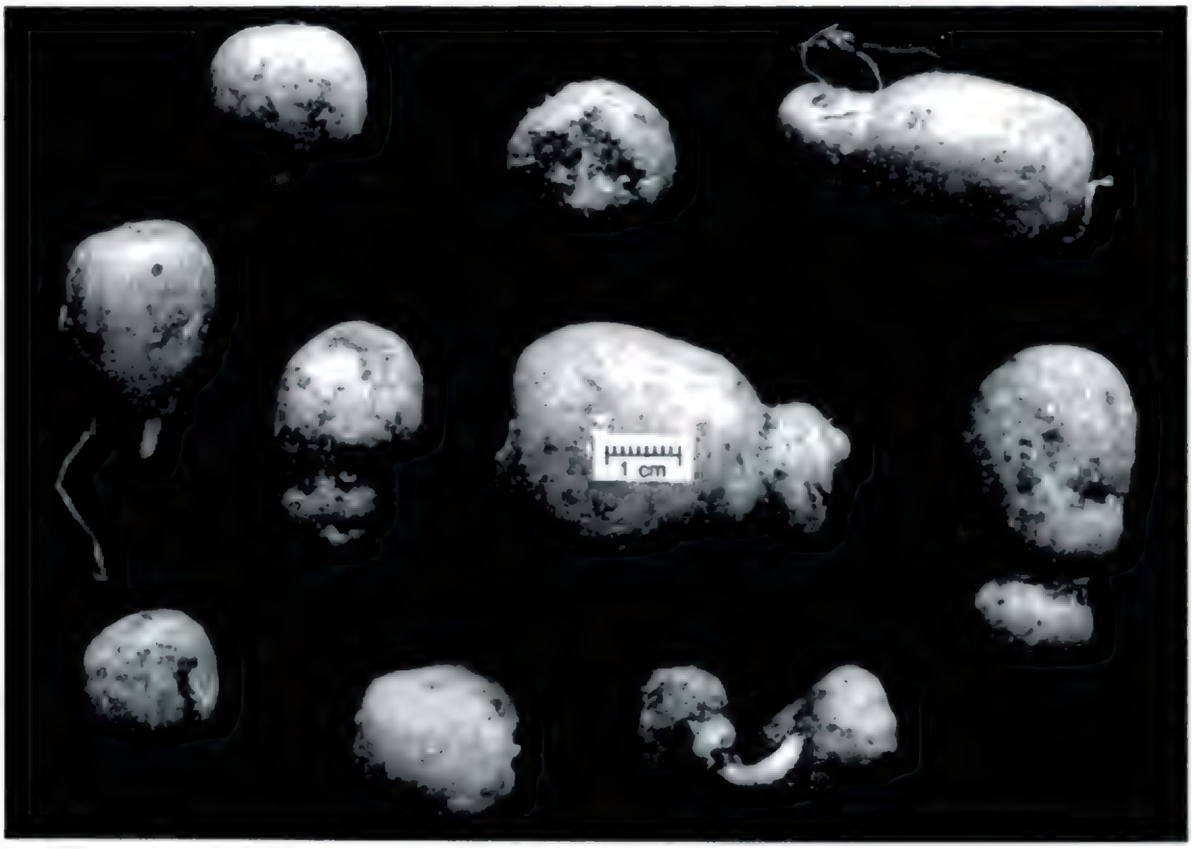


Figure 370. Tubers of *Solanum orophilum* (*Ochoa 13020*).

Province Santiago de Chuco: Mumpamba, 3200 m alt., facing the Hacienda San José, along the route Cachicadán-San José, 25 May 1963, C. *Ochoa 2510* (CIP, MOL, OCH, UNTC, USM, US) and *2510A* (OCH, plants propagated from botanical seed at La Molina, Lima).

Breeding Potential

The results of crosses of *S. orophilum* with diploid species (2n=24) of EBN=2 and tetraploid species (2n=48) of EBN=2 and EBN=4 are given in Table 94, while the materials used in these experiments are shown in Table 95.

A large number of seeds per berry were obtained on the average in reciprocal crosses of *S. orophilum* with *S. marinasense*, *S. sparsipilum*, *S. coelestispetalum*, *S. bukasovii*, *S. ambosinum* and the cultivated potatoes *S. goniocalyx* and *S. phureja*, all diploid species of Series Tuberosa. However, reciprocal crosses with *S. huancabambense*, which is also of Series Tuberosa, gave comparatively low seed yields, and then only when *S. huancabambense* was used as the staminate parent.

The reciprocal crosses with *S. rhombilanceolatum* of Series Conicibaccata, while successful in some cases, gave only relatively few seeds per berry. On the other hand, the unilateral crosses made with *S. chomatophilum* (another species of Series Conicibaccata) were highly successful, yielding many seeds per berry on the average.

Large numbers of seeds were also obtained in reciprocal crosses of *S. orophilum* with *S. sogarandinum* of Series Megistacroloba when the latter species was used as the staminate parent, but far fewer when it was used as the pistillate parent.

Lastly, the unilateral crosses made with *S. tuberosum* subsp. *andigena*, this involving only one accession (*No. 12076*) of the cultivated species, were very difficult to achieve. While many berries were obtained, very few seeds formed on the average.

Table 94. Fertility of *Solanum orophilum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	CONICIBACCATA	× *S. chomatophilum*	40	10	83
			× *S. rhombilanceolatum*	15(2)	1(1)	31(5)
24	2	MEGISTACROLOBA	× *S. sogarandinum*	24(4)	8(2)	98(15)
24	2	TUBEROSA	× *S. ambosinum*	17(12)	7(11)	50(332)
			× *S. bukasovii*	170(235)	125(186)	229(263)
			× *S. bukasovii* f. *multidissectum*	9(10)	6(4)	97(132)
			× *S. coelestispetalum*	152(120)	101(91)	242(178)
			× *S. goniocalyx*	41(23)	21(14)	105(172)
			× *S. huancabambense*	19(4)	13(1)	38(0)
			× *S. marinasense*	8(21)	5(15)	344(86)
			× *S. multiinterruptum*	27	14	9
			× *S. phureja*	5(7)	1(6)	70(286)
			× *S. sparsipilum*	43(50)	29(26)	283(37)
48	2	ACAULIA	× *S. acaule*	3(2)	2(2)	0(0)
48	4	TUBEROSA	× *S. tuberosum* subsp. *andigena*	76	55	3

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 95. Collections (OCH) used in *Solanum orophilum* fertility studies.

ACAULIA
S. acaule 10111, 11296

CONICIBACCATA
S. chomatophilum 13010, 13203
S. rhombilanceolatum 14406

MEGISTACROLOBA
S. sogarandinum 13006

TUBEROSA
S. ambosinum 11865, PI 458405
S. bukasovii 11293, 11337, 11841, 11859, 13115, 13166, 13168, 13173, 13174, 13279, 13576, 13599, 13676, 13696, 13707, 13713, 13715, 13796, 13814, 13856, 13858, 13859, 13862, 14360
S. bukasovii f. *multidissectum* 11843, 11868, 13581, 13771
S. coelestispetalum 7711, 13591, 13597, 13609, 13632, 13686, 13687, 13690, 13693, 13716, 13717, 14326
S. goniocalyx 00001
S. huancabambense 11619, 11627
S. marinasense 13673, 13675, 13738
S. multiinterruptum 11696, 11704
S. orophilum 12077, 12078, 12079, 12080, 12082, 12095, 13003, 13011, 13020, 13021, 13022, 13023, 13318, 13323
S. phureja 13910, 15131, 15135
S. sparsipilum 13588, 13774
S. tuberosum subsp. *andigena* 12076

75. *Solanum pampasense* Hawkes, Bull. Imp. Bur. Pl. Breed. Genet., Cambridge 50, 125, Fig. 40, 1944; *The Potato*, p. 146, 1990., Belhaven Press, Pinter Publishers, London.

Fig. 371-373; Map 27.

Plant 25-50 cm tall, bushy, semi-rosette-forming at base, sparsely pilose; stem simple or somewhat branched, 5-7 mm in dia. at base, with white and sparsely distributed unequally long hairs; internodes 1.5-2.0 cm long at base and 5-6 cm long in the upper one-third of the stem. Plant stoloniferous and tuber-bearing; tubers small, light brown. Leaves imparipinnate very short and broad, 12.5-20.0 cm long by 8.0-16.0 cm wide, with 4-5 pairs of leaflets and 4-7(-10) pairs of small, sessile interjected leaflets, these of 2-3 different sizes; petioles 1-2 cm long. Leaflets subglabrous or sparsely and shortly pilose above and somewhat more densely pilose-tomentose below, ovate-lanceolate to elliptic or elliptic-lanceolate, with an obtuse or very shortly acuminate apex and an obliquely rounded base, long-petiolulate, petiolules (3-)6-10 mm long; the leaflets of the first and second upper pairs sometimes bearing one very small, basally-acroscopic interjected leaflet, 3-5 mm long. Terminal leaflets 3.5-6.0 cm long by 2.5-4.0 cm wide, of the same size or slightly larger than the adjacent laterals and broadly rounded or cordate at base. Pseudostipular leaves broadly elliptic-lanceolate, to 1 cm long. Inflorescence pseudoterminal, cymose, 10-15-flowered; peduncle 8-12 cm long, bifurcate, sparsely and shortly glandular-pilose; pedicels 15-30 mm long, articulated slightly above the midpoint or 7-10 mm below the base of the calyx. Calyx symmetrical or asymmetrical, 9-11 mm long, with unequally long ovate-lanceolate lobes, sparsely glandular-pilose, with pointed or obtuse acumens 2.0-5.0 mm long. Corolla pale blue or pale blue-violet, 3-4 cm in dia., rotate, with very short lobes and acumens. Anthers lanceolate, 5-6 mm long; filaments 2.0-2.5 mm long, glabrous. Style 9-10 mm long, papillose below center; stigma capitate, emarginate. Fruit globose, light green, 1.5 cm in dia. Chromosome Number: 2n=24. EBN=2.

Type: PERU. Department of Apurímac, Province Andahuaylas, Río Pampas valley, 4 leagues above Pajonal, east side of river, 7000 ft. alt. [about 2300 m], 24 May 1939, *E.K. Balls and J.G. Hawkes 7007* (CPC, K, from specimen grown in field at Cambridge, England).

Affinities

This species is related to *S. bukasovii*. The two are alike with respect to their semi-rosette habit, and have leaflets of similar shape and pilosity. The main difference between them is that *S. pampasense* has longer flowering pedicels and leaflet

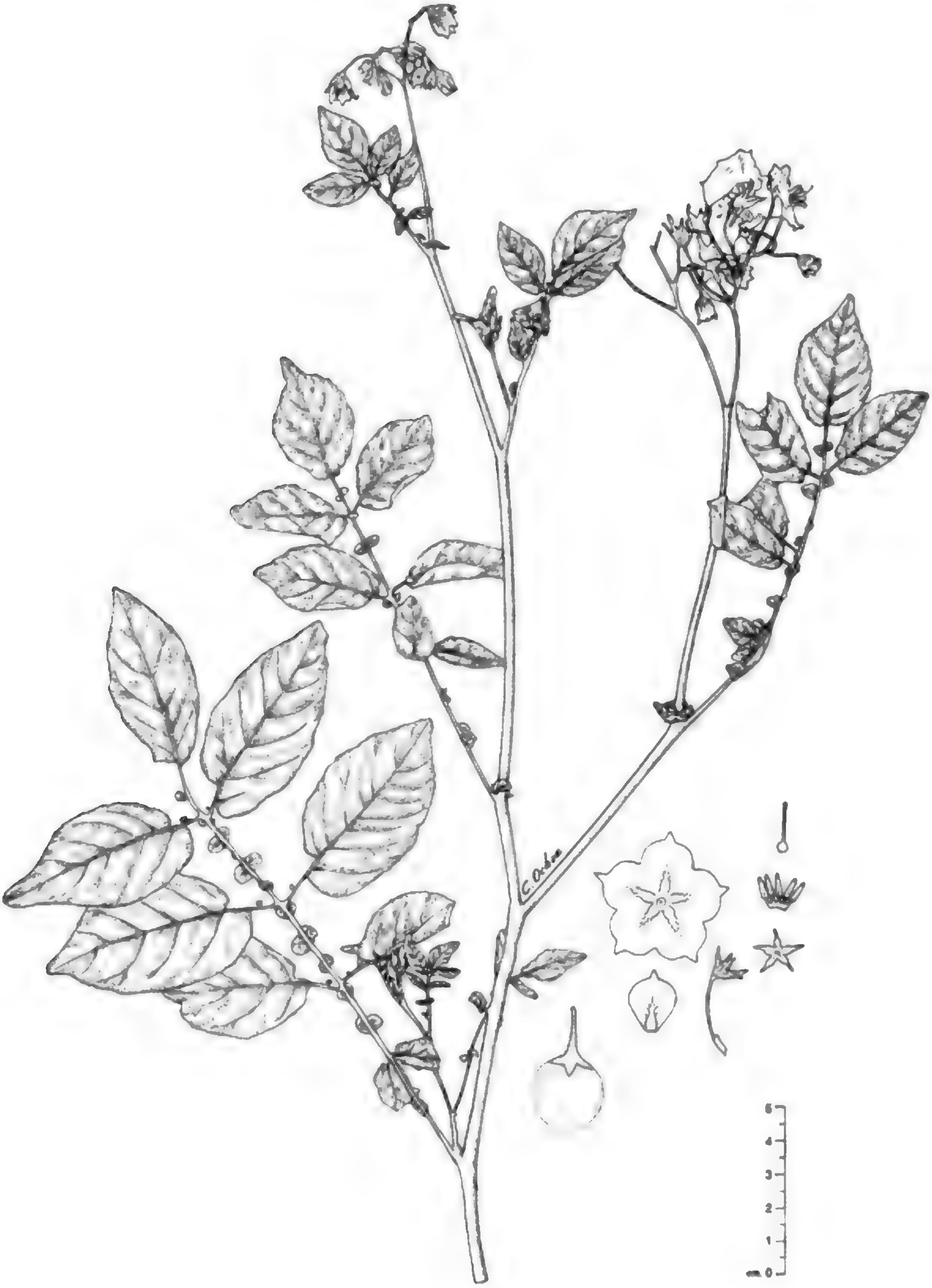


Figure 371. *Solanum pampasense (Ochoa 2623).*

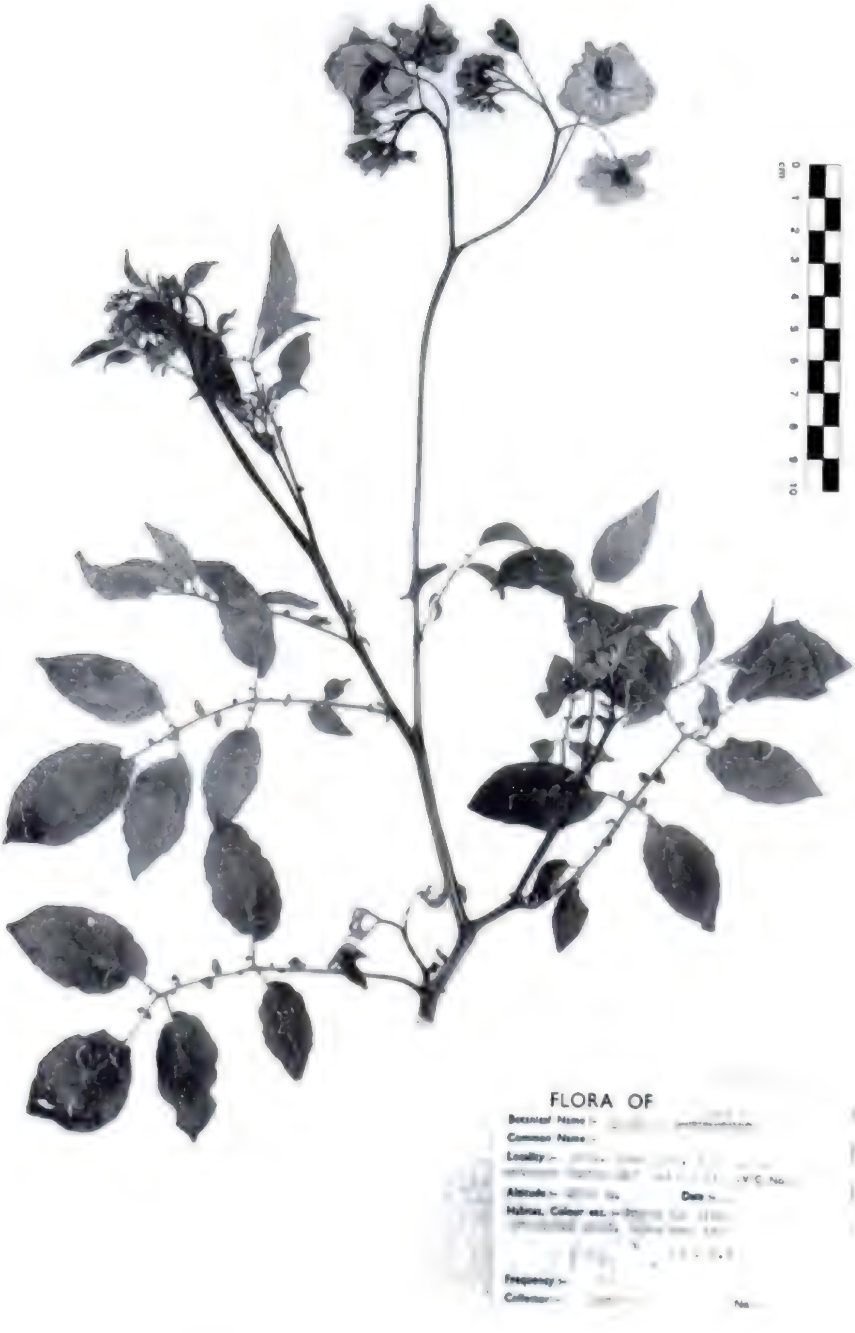


Figure 372. *Solanum pampasense* (*Hjerting 1420*).

petiolules and the calyx lobes are of different size and appear more irregular. Although requiring further study, these features of *S. pampasense*, plus the fact that it is highly localized in distribution, are suggestive of a hybrid origin for this plant from *S. bukasovii* and another wild diploid species, possibly *S. marinasense*.

Habitat and Distribution

Solanum pampasense occurs in the semi-dry interandean valleys of the Departments of Ayacucho and Apurímac in southern Peru, at altitudes between 2300 and 2700 m (Map 27).

Specimens Examined

Department Apurímac

Province Andahuaylas: Río Chincheros, 2300 m alt., collected in 1959, *H. Ross EBS-1894 = PI-275274* (CIP, plants grown at Huancayo from seed received from Sturgeon Bay, Wis., U.S.A.). Asmaj, 2800 m alt., in the valley of the Río Pampas, between Ocros and Chincheros, about 15 km above Pajonal, in an herbaceous association, 15 March 1967, *C. Ochoa 2623* (CIP, MOL, OCH, USM). Andahuaylas, 2600 m alt., (lat. 13°07' S, long. 74°13' W), Ayacucho road above Rio Pampas, 12 km below Chincheros. April 18, 1971, *Hawkes, Hjerting, Cribb, and Z. Huamán 5229 = PI-442697* (OCH, plants propagated at Huancayo from seed received from Sturgeon Bay, Wis., U.S.A. and CIP, from original and from plants propagated in the greenhouse at Huancayo and La Molina, Lima). Pampas Valley, about 4 leagues above Pajonal on the south side of the river, about

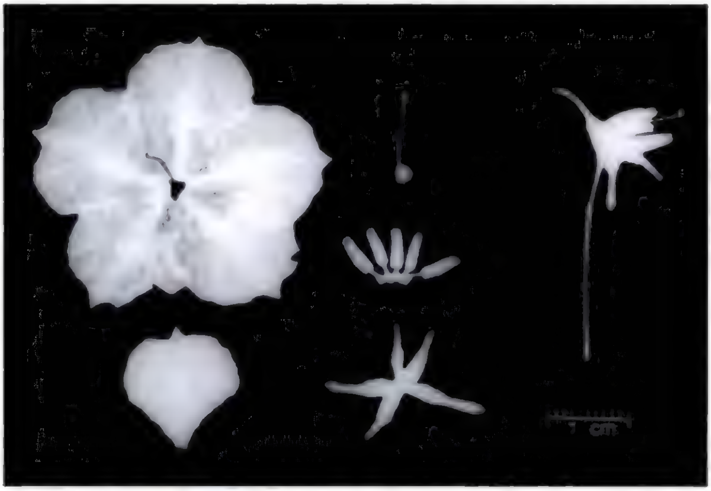


Figure 373. Floral dissection of *Solanum pampasense* (*Hjerting 1420*).

7000 ft., ripe fruit only, 24 May 1939, *E.K. Balls and J.G. Hawkes 7007* (CPC, K, type collection, not seen, specimens grown in the field at Cambridge, England, phototype at LL seen).

Department Ayacucho

Province Cangallo: Pajonal, 2000 m, between Ocros and Andahuaylas, collected in 1953, *Hjerting 1420* (OCH, plants grown at Birmingham from original seed collected by Hjerting; OCH, from plants grown in the greenhouse at Huancayo and CIP, propagated at La Molina, Lima, from seed *PI-210046*). Cangallo, 2400 m alt. [2577 m], 13° 23' Lat. S and 73° 15' Long. W, 7 km from Río Pampas, bridge, under cactus plants, 18 April 1971, *Hawkes, Hjerting, Cribb, and Huamán 5230* (OCH, from plants propagated at Huancayo and CIP from plants grown at La Molina, Lima, propagated from seed *PI-458381*).

Province Huamanga: Chumbis, 2600 m, 5 km before the village (13° 25' Lat. S, 73° 54' Long. W, collected in 1959, *H. Ross EBS-1895* (OCH, from plants grown at Huancayo and CIP, propagated at La Molina, Lima, from seed *PI-275275* received from Sturgeon Bay, Wis., USA).

76. *Solanum puchupuchense* Ochoa *sp. nov.* (See Latin diagnosis in Spanish edition).

Fig. 374; Map 23.

Plant robust, erect to erect-ascending, 1.0-1.50 m or more tall, finely pubescent or puberulent on all its parts; stem simple or branched, thick, up to 2 cm in dia. at base, wings 1.0-1.5 mm wide, straight or somewhat sinuous at base, light green, sparsely pilose, with very short, white hairs; internodes 3.0-5.5(-7.0) cm long. Stolons nearly 1 m long; tubers whitish-yellow, round to ovoid, 3-5 cm long. Leaves green to light green, sparsely pilose above with very short, white, adpressed hairs, densely puberulent below; leaves 17.5-25.0(-27.0) cm long by 8.5-12.5(-14.5) cm wide, imparipinnate with (2-)3-4 pairs of lateral leaflets and 0-2(-4) pairs of interjected leaflets. Lateral leaflets narrowly elliptic-lanceolate, acuminate at tip and obliquely rounded at base, on petiolules 1.5-5.0 mm long, the base of the leaflets of the first upper pair narrowly or broadly decurrent about the rachis along the basiscopic side. Terminal leaflet somewhat larger than the adjacent laterals, 7-8 cm long by 3-4 cm wide, broadly elliptic-lanceolate or slightly ovate-lanceolate, acuminate at tip and attenuate to subcuneate at base; the first pair of lateral leaflets 5.0-7.5 cm long by 2.0-2.7 cm wide. Interjected leaflets, when present, orbicular to elliptic, 2-12 mm long, sessile. Pseudostipular leaves narrow and asymmetrically elliptic or broadly subfalcate, up to 15 mm long by 9 mm wide. Inflorescence cymose or cymose paniculate, 10-20-flow-

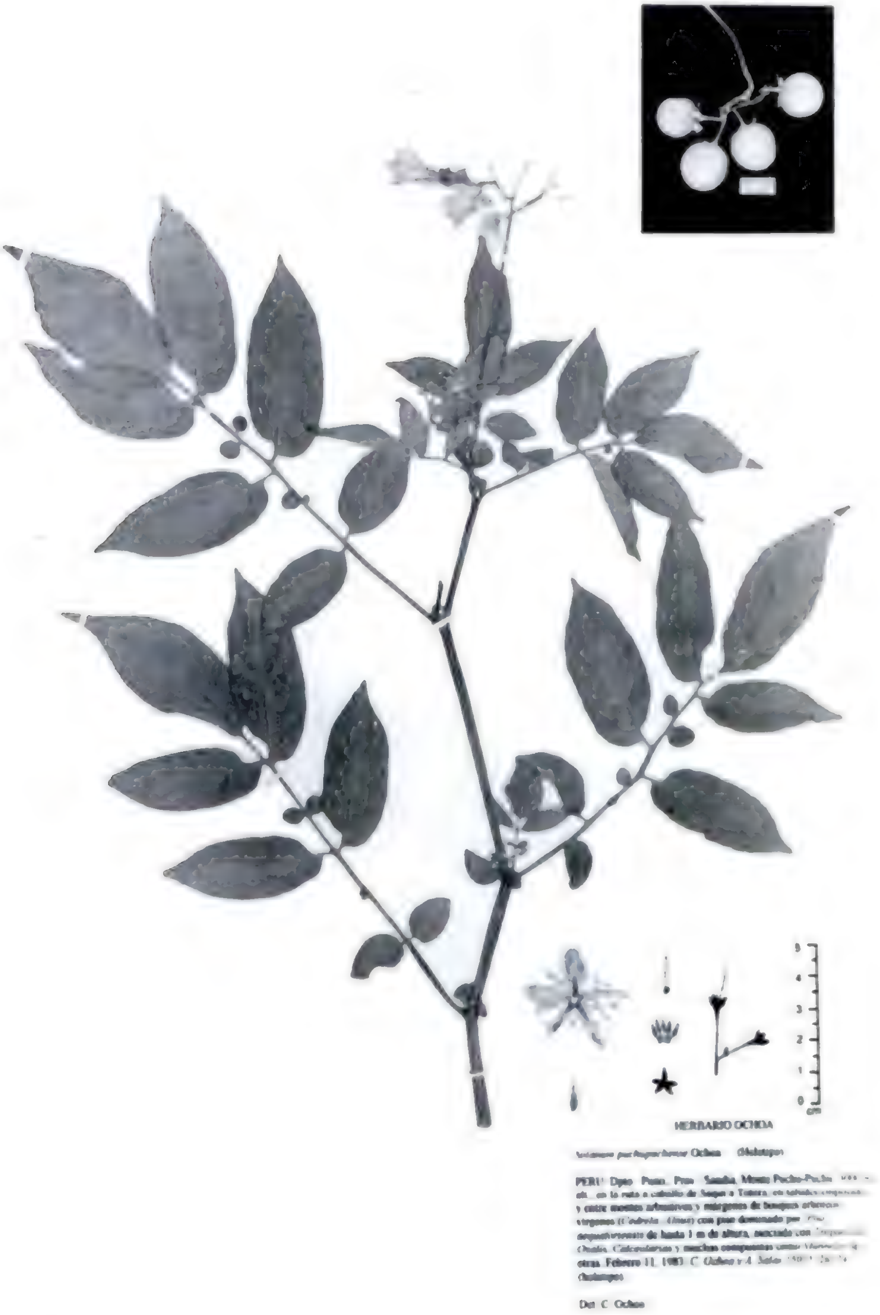


Figure 374. Plant, floral dissection and fruits of *Solanum puchupuchense*, (*Ochoa et Salas 15015*, holotype).

ered; peduncle 8-12(-15) cm long and 2.5 mm in dia., puberulent like the pedicels and calyx; pedicels short, 15-20 mm long, articulated at the midpoint or slightly above center, or about 8-10 mm below the base of the calyx. Calyx 6-7 mm long, symmetrical or asymmetrical, lobes ovate-lanceolate or somewhat rhombic, abruptly pointed or attenuate, the margins narrowly scarious at base. Corolla rotate, 2.5-3.0 cm in dia., violet-lilac. Anthers lanceolate, 5 mm long, deeply cordate at base; filaments short, 3-5 mm long, glabrous. Style 9 mm long, glabrous or very sparsely papillose along the basal one-third of its length; stigma capitate, small. Fruit round, light green, 1.5 cm in dia. Chromosome Number: 2n=24. Proposed Abbreviation: PCH.

Type: PERU. Department Puno, Province Sandia, Monte Puchupuchu, 3000 m alt., along the horse trail from Saqui to Totora, among mountain shrubs and along the margins of tree forests, 11 February 1983, *C. Ochoa and A. Salas 15015*, 2n=24 (holotype OCH, isotypes CIP, MOL, OCH, USM). **Paratype:** Department Puno, Province Sandia, near Chimpachina Pampa, 3200 m alt., south-southeast of Sina, 13 February 1983, C. *Ochoa and A. Salas 15024*, 2n=24 (OCH) (isoparatypes MOL, USM).

Affinities

This species is related to *S. candolleanum*. The two are similar in having a robust habit, a tall erect-ascending stem and acuminately-tipped, elliptic-lanceolate leaflets. However, it differs markedly from *S. candolleanum* in having leaves that are much more dissected and in having a much smaller corolla, longer flowering pedicels and smaller, pure green fruits.

Habitat and Distribution

Solanum puchupuchense grows on sloping escarpments in association with *Stipa ichu* and *Poa aequatoriensis* and other grasses, as well as in combination with various thicket herbs such as *Tropaeolum*, *Oxalis* and *Calceolaria*. It is also found in quebradas in relic stands of shrubs, along the margins of *Alnus* and *Cedrela* forests and in valleys having transitional climates between *puna* and *ceja de montaña*, at elevations ranging between 3000 and 3600 m.

This species is common to both Peru and Bolivia. It is known from both the east and west sides of the Cordillera de Apolobamba, from the Province of Sandia in southeastern Peru to the Province of Franz Tamayo in northwestern Bolivia (Map 23).

Specimens Examined

BOLIVIA

Department La Paz

Province Franz Tamayo: Jatun Senkka, 3200 m alt., between Puina and Sayhuanimayo, right bank of the río Puina, plant more than 1 m tall, stem thick, up to 2.5 cm in dia. at the base, conspicuously winged, associated with *Bromus pitensis*, *Blechnum* sp. and *Tropaeolum* sp., 9 February 1983, *C. Ochoa and A. Salas 14990* , re-examined in November 1995 (CIP, OCH). Chromosome Number: 2n=24.

PERU

Department Puno

Province Sandia: Monte Puchu-Puchu, 3000 m alt., along the horse trail from Saqui to Totora, on steep talus slopes and among mountain shrubs and the margins of virgin tree forests (*Cedrela, Alnus*) with understory dominated by *Poa aequatoriensis* up to 1 m tall, associated with *Tropaeolum, Oxalis, Calceolarias* and many composites as *Munnezia* sp. and others, 11 February 1983, *C. Ochoa and A. Salas 15015*, 2n=24 (CIP, MOL, OCH, USM, type collection of *S. puchupuchense*) (CIP, OCH, plants grown in the greenhouse at Huancayo and CIP, MOL, OCH, USM, from plants grown at La Molina, Lima). Near Chimpachina Pampa, 3200 m alt., south-southeast of Sina, flowers small, light violet-lilac, 13 February 1983, *C. Ochoa and A. Salas 15024*, 2n-24 (paratype OCH, isoparatypes MOL, USM).

77. *Solanum sandemanii* Hawkes, Ann. Mag. Nat. Hist., Ser. 12, 7:709, Figs. 12-13, 1954. Fig. 375; Map 28.

Plant erect, small, (25-)30-50(-60) cm tall, sparsely pilose; stem simple or little-branched, 4-8 mm in dia. at base, narrowly and inconspicuously winged, slightly pigmented in the basal one-third of its length; internodes (1-)2.5-45.(-6.0) cm long. Stolons 40-60 cm long, very slender, 1.5-2.5 mm in dia.; tubers white, 2-4 cm long, round to ovoid. Leaves imparipinnate, (7.5-)9.5-15.5(-18.0) cm long by (3.5-)6.5-8.5(-12.0) cm wide, sparsely pilose, more densely pubescent with coarse, short, white hairs on the rachis of the upper surface and less pilose below, with 2-3(-4) pairs of leaflets and 0-1 pair of interjected leaflets. Leaflets elliptic-lanceolate or lanceolate to linear-lanceolate, with pointed or shortly acuminate tips and obliquely rounded bases, sessile or subsessile, the margins pilose, irregular, and very finely dentate. Terminal leaflet somewhat more broadly elliptic than the

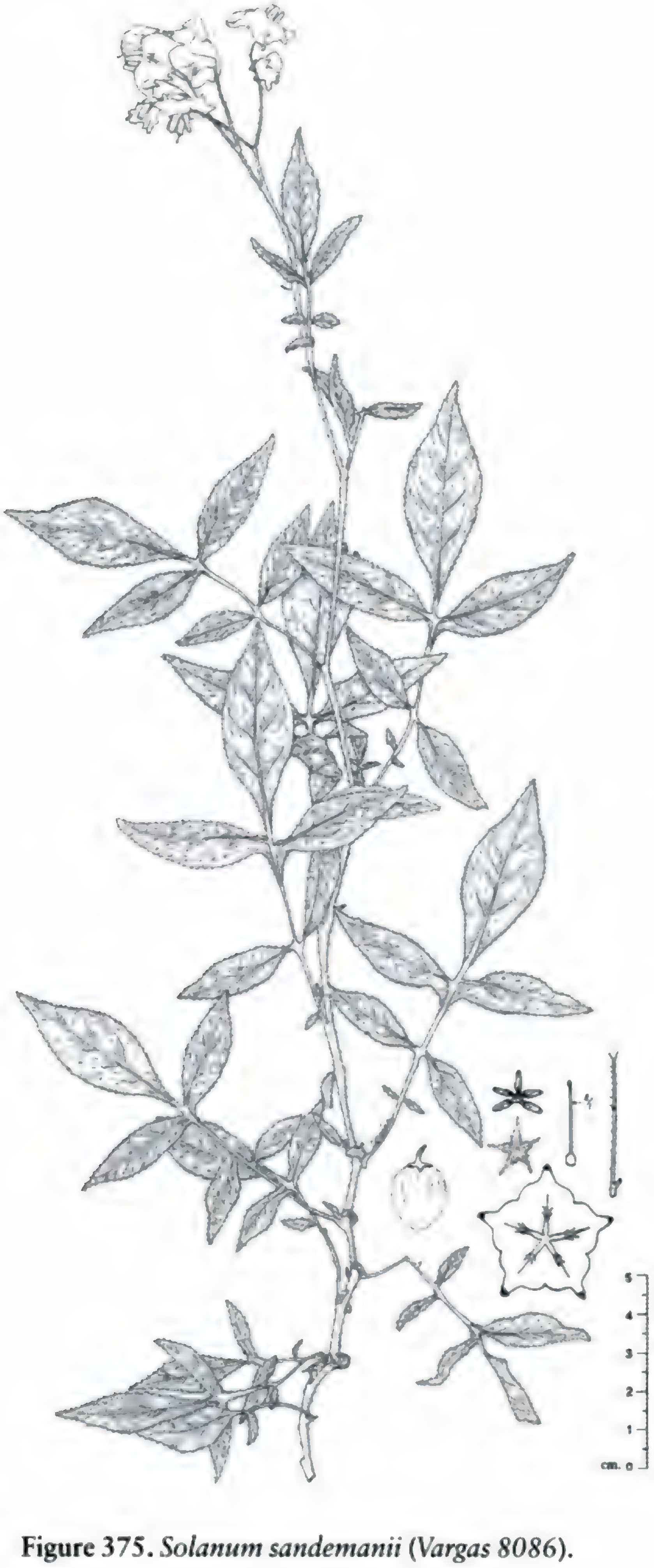


Figure 375. *Solanum sandemanii* (*Vargas* 8086).

laterals, or simply lanceolate to obovate rhombic-lanceolate, (3-)4-6 cm long by (1.5-)2.0-3.0 cm wide, with shortly acuminate tips and cuneate bases; the first pair of lateral leaflets (2.5-)3.5-5.5 cm long by (1.0-)1.5-2.5 cm wide, the base decurrent about the rachis along the basiscopic side, occasionally forming a broad decurrent wedge, or deltoid, long-cuneate wing. Interjected leaflets, when present, elliptic, sessile, very small, 3-5 mm long. Pseudostipular leaves estipulate, broadly falcate, 5-9 mm long by 3-5 mm wide, with pointed tips and crenulate margins. Inflorescence cymose, (4-)6-15-flowered; peduncle 10-15 cm long, sparsely pilose; pedicels 15-20 mm long, sparsely pilose, articulated high above the midpoint or about 4-5 mm below the base of the calyx. Calyx usually asymmetrical, densely pubescent, 8-10 mm long; lobes narrowly elliptic-lanceolate, with margins scarious at base, narrowing to long linear or subspatulate acumens, 3-5 mm long. Corolla rotate, purple-violet, 3.0-3.5 cm in dia. Anthers 5 mm long; filaments 1.0-1.5 mm long, glabrous. Style 8-9 mm long, papillose along the basal one-third of its length; stigma subcapitate. Fruit ovoid to subglobose, 1.5 cm long. Chromosome Number: 2n=24.

Local Name: *Tomatillo*, near Arequipa.

Type: PERU. Department Arequipa, along the borders of a rocky slope, above Arequipa, 2600-2700 m alt., corolla purple, 7-16 April 1925, *F.W. Pennell 13196 p.p.* (lectotype, here designated; F, isolectotypes GH, K, NY, PH, S).

Affinities

Solanum sandemanii is closely related to both *S. medians* var. *autumnale* and *S. tacnaense* f. *decurrentialatum*.

Habitat and Distribution

This species grows preferentially in high mountain regions and in quebradas having a cool to temperate climate. Of the more than 20 collections of this species that were examined during the preparation of this study, 17 were from localities situated between 2500 and 3200 m, while the remaining few came from *prepuna* or *puna* habitats at elevations between 3400 and 3800 m.

Solanum sandemanii grows in many types of soil and habitat associations. It has been collected in the vicinity of cultivated fields rich in organic materials; in thickets comprised of various herbs, shrubs and grasses, including *Chenopodium*, *Briza*, *Poa*, *Cortaderia* and several composites; in very poor sandy or sandy-clay soils; in gravelly soils or on rocky talus slopes; and, in very dry, rocky areas associated with various genera of columnar cactus, such as *Acanthocereus* and *Neoraimondia*.

At present, this species is known only from the Provinces of Arequipa, Cailloma and Condesuyos in southern Peru (Map 28).

Specimens Examined

Department Arequipa

Province Arequipa: Southern slopes of Chachani Mountain, north of Arequipa, ravines, 2500 m alt., herb 12"-15" tall, flower purple, n.v. *Tomatillo cimarron*, March 1920, Mr. & Mrs. *F.E. Hinkley 46* (GH, NY, US). Rock-ledges along draw above Arequipa, 2600-2700 m, corolla "royal-purple," 7-16 April 1925, *F.W. Pennell 13196 p.p.* (F, GH, K, NY, PH, S, type collection of *S. sandemanii*). Baños de Jesús, Arequipa, 9500 ft. alt., annual herb with bright violet flowers and 2 ft. high, frequent, February 1943, *C. Sandeman 3812* (K, paratype of *S. sandemanii*). Quebrada de Ccontay, along the route Jesús-Chihuata, 2900-3100 m alt., corolla deep blue, fruits ovoid, in rocky soil, among trees, 31 March 1949, *C. Vargas C. 8086* (CUZ, LL, OCH). Near Chihuata, 3100 m alt., 31 March 1949, *C. Vargas C. 8094* (CUZ, OCH). Arequipa, March 1953, *Peterson and J.P. Hjerting 1108* (CA, LL). Chihuata, 2900-3100 m alt., on rocky talus slopes, plants up to 60 cm tall, stems up to 8 mm in dia., leaflets pilose, elliptic-lanceolate, peduncles up to 20 cm long, with 7-10 violet flowers, 17 March 1953, *C. Ochoa 2033* (OCH) and *2034* (GH, OCH). Chihuata, 2900 m alt., plants 30 cm tall, flowers purple, March 1953, *C. Ochoa 2082* (OCH). Cerros de Jesús, 3000 m alt., 10 April 1959, *C. Vargas C. 12679* (CUZ, OCH). Between Huasaloma and Candamo, 2940 m alt., above Jesús, in gravelly soils, associated with *Chenopodium* sp., grasses as *Briza* and *Cortaderia*, in the shade of small trees of *Schinus molle*, 27 March 1974, *C. Ochoa 5046* (CIP, OCH, GH, US), *5047* (CIP, OCH) and *5057* (CIP, OCH, GH, US). Cuesta de Liquirca, 3260 m alt., heading up from Yura to Huanca, in a cold windy habitat, in rocky soil, xerophyte, within large associations of columnar cacti represented principally by *Cereus*, *Acanthacereus* and *Neoraimondia*, growing with grasses and composites, tubers 2-3 cm in dia., round and ovoid, 28 March 1974, *C. Ochoa 5061* (OCH, CIP), *5070* (CIP, OCH, US) and *5071* (CIP, OCH, GH). Heading up from Liquirca toward the mountain crest of Pampacollo, 3410 m alt., in very poor, dry rocky soils, 28 March 1974, *C. Ochoa 5080* (OCH) and *5081* (CIP, OCH).

Province Cailloma: Heading down from Pampacollo toward Huanca, 3620 m alt., on rocky talus slopes, 28 March 1974, *C. Ochoa 5072* (OCH).

Province Condesuyos: Cabracancha, 3000-3400 m alt., on mountain talus slopes, 23 April 1967, *C. Vargas C. 19441* (CUZ, OCH).

Above Chuquibamba, 3750-3900 m alt., on stony or rocky land, 14 April 1967, *C. Vargas C. 19458* (CUZ, OCH).

78. ***Solanum sarasarae*** Ochoa, Phytologia 64(4):245-246, illustr., 1988.

Fig. 376-378; Map 19.

Plant erect, small, 25-35 cm tall, sparsely pilose, hairs very short and scarcely distinguishable; stem simple or little-branched, 3-5(-7) mm in dia., slightly pigmented, purple at the base and in the leaf axils, the top portion light green; internodes short, 1.5-2.5 cm long. Stolons up to 60 cm long, very slender; tubers small, 1.0-1.5 cm in dia., white, ovoid or round. Leaves narrowly decurrent about the stem, very shortly and sparsely pilose above and below, somewhat more densely puberulent on the principal nerves, the rachis and the petiolules; leaves imparipinnate with (5-)6 pairs of leaflets and 12-15 pairs of interjected leaflets. Terminal leaflet ovate to obovate, rarely suborbicular, 2-3(-4) cm long by 1.0-2.5(-3.0) cm wide, obtuse to subpointed at the tip and broadly rounded to subcuneate at base; lateral leaflets elliptic-lanceolate or narrowly elliptic-lanceolate, the base symmetric or asymmetrically rounded and shortly petiolulate, petiolules 1-2 mm long, slightly pigmented. Leaflets of the first upper pair 1.5-3.5 mm long by 0.7-2.0 mm wide, the remaining pairs of leaflets gradually diminishing in size toward the base, the last two or three lower pairs being very small and sessile. Interjected leaflets numerous, varying in size from 1-10 mm long. Pseudostipular leaves narrowly falcate, small, 5-7 mm long by 3 mm wide, orbicular to ovate, sessile. Inflorescence cymose, 4-6-flowered; peduncle light green, short, 3-6 cm long by 1.5-2.0 mm in dia., puberulent as in the case of the pedicels, the trichomes intermixed with a few very small glandular-tetralobular hairs; pedicels 12-15 mm long, articulated 3-4 mm below the base of the calyx. Calyx symmetrical, small, 5.0-5.5 mm long, pigmented or slightly so at base, the remainder green; lobes subcuadrate at tip, narrowed to pointed or slightly pointed and very short acumens, 1.0-1.5 mm long. Corolla rotate to rotate-pentagonal, small, 2.0-2.5 cm in dia., light blue-violet, lobes 3-4 mm long, with short and very fine acumens, 1.5-2.0 mm long, internal star grayish-white. Anther column truncate-conical, asymmetrical; anthers scarcely 3.5-4.0 mm long, light yellow; filaments 0.4-0.8 mm long, glabrous. Style 8.0-8.5 mm long, slender, to 4 mm, densely papillose along the lower two-thirds of its length, the papillae very short; stigma claviform, cleft, slightly enlarged at apex of the style. Fruit round, pale green, 10-14 mm in dia. Chromosome Number: 2n=24. EBN=2.

Type: PERU. Department Ayacucho, Province Parinacochas, a few km southwest of Chilcar in the direction of the lower slopes of Cerro Pucapuca, near massive Mt. Sara Sara, ca. 3000-3300 m alt., March 1973, C. *Ochoa 4197* (holotype OCH, isotype US).

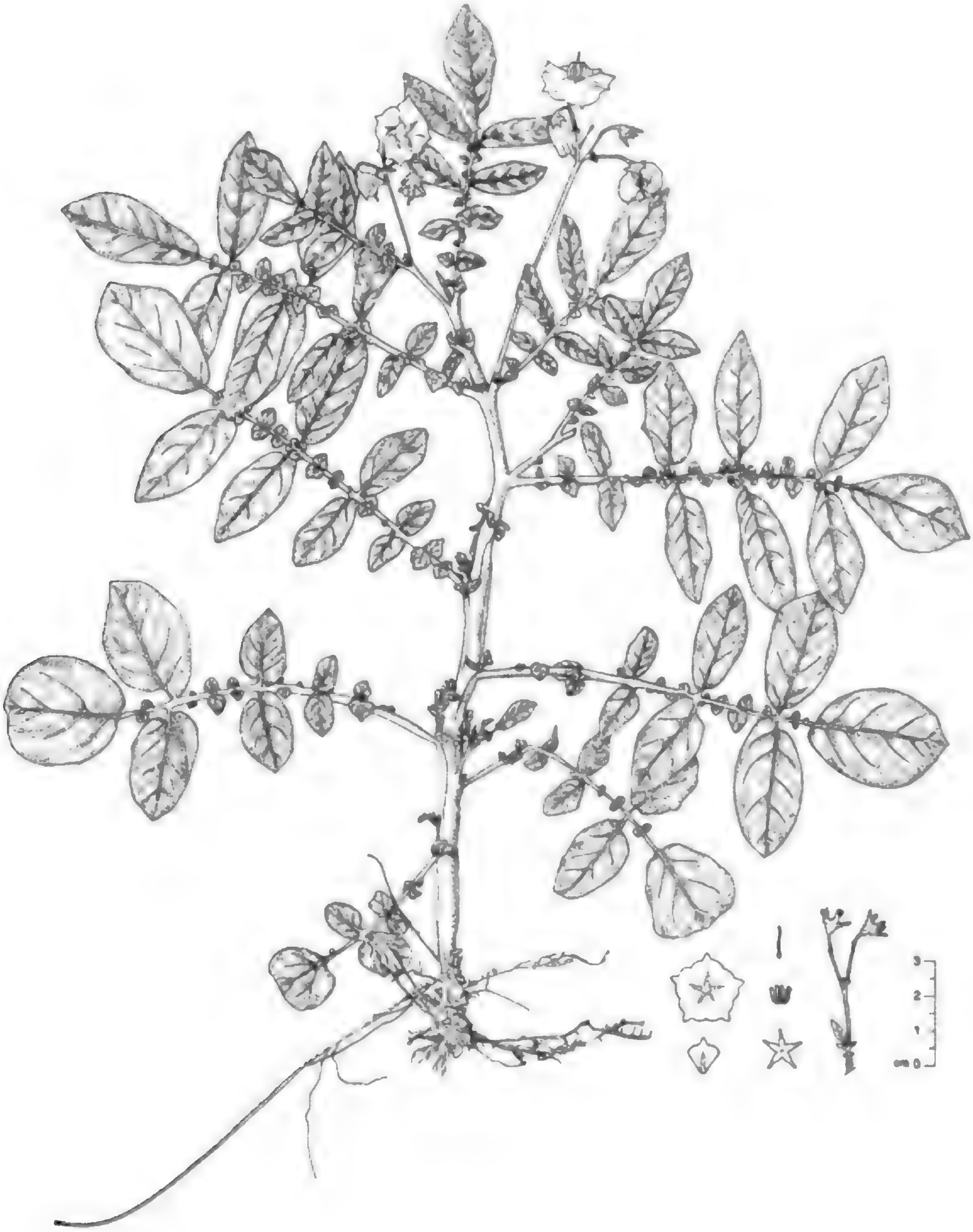


Figure 376. Plant and floral dissection of *Solanum sarasarae* (*Ochoa 4197*, holotype).

Affinities

Although this species is similar to *S. bukasovii* in having strongly dissected leaves, it differs markedly in many other respects, including the lack of a rosette habit, the shape of the leaves and leaflets, the short, fine indumentum over the entire plant, the occurrence of small globose fruits, and, above all, the very small corolla and very high articulation of the pedicels.

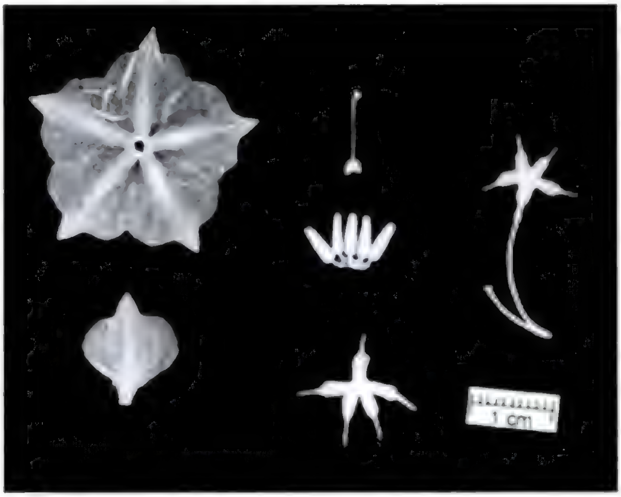


Figure 377. Floral dissection of *Solanum sarasarae* (*Ochoa 14919*).

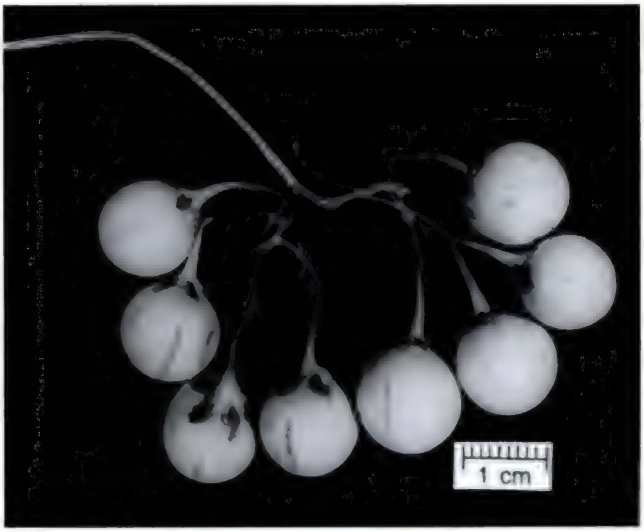


Figure 378. Fruits of *Solanum sarasarae* (*Ochoa 14919*).

Habitat and Distribution

Solanum sarasarae grows in the cool *prepuna* and *puna* formations of the very high mountain areas (3000-4000 m alt.) in the vicinity of massive Mt. Sara Sara, the latter located in southern Peru in the Province of Parinacochas, Department Ayacucho (Map 19).

Specimens Examined

Department Ayacucho

Province Parinacochas: A few km southwest of Chilcar, in the Unilateralion of Cerro Pucapuca, near massive Mt. Sara Sara, ca. 3000-3300 m alt., between trees of *Polylepis* sp. and some spherical cacti, *Lobivia* sp., on poor rocky soil, March 1973, *C. Ochoa 4197*, 2n=24 (OCH, US, type collection of *S. sarasarae*). Yuracchuasi, 3500 m alt., District Chumpi, grassland, April 1975, *C. Ochoa and A. Salas 9962* (MOL, OCH, UNTC, USM). Lower slopes of Sara Sara, 3900-4000 m alt., two hours by foot from Quilcata, among trees of *Polylepis incana*, shrubs of *Lepidophyllum and* much *Stipa ichu*, only tubers were collected, 20 February 1983, *C. Ochoa 14919*, 2n=24 (MOL, OCH, UNTC, USM, plant propagated from tubers at Huncayo). Heading down from Umaschalla, 3400 m alt., walking down towards Huamanpampa, plants very small, 10-20 cm tall, flowers light blue, 23 February 1983, *C. Ochoa 14922*, 2n=24 (MOL, OCH, plants propagated at La Molina, Lima). Moyococha, ca. 3100 m alt., near Huamanpampa, 27 February 1983, *C. Ochoa 14925*, 2n=24 (MOL, OCH).

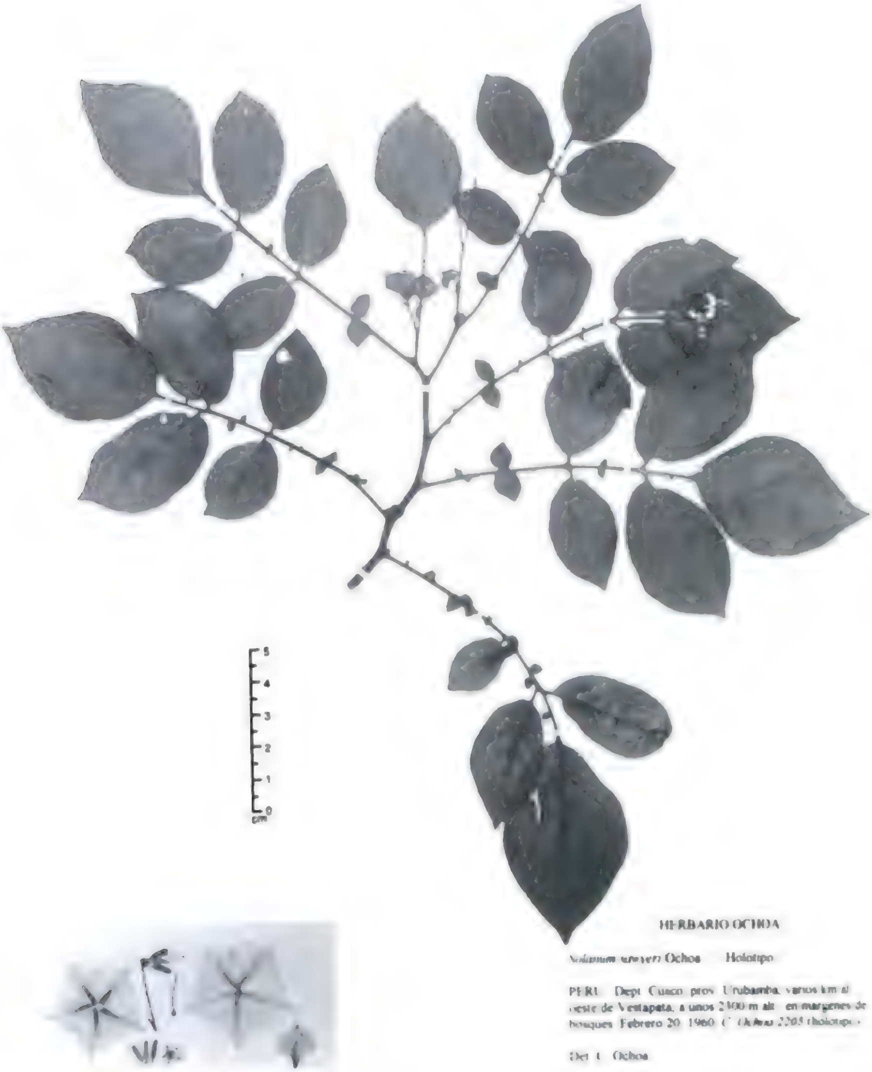
Breeding Potential

The reciprocal crosses of *S. sarasarae* (*OCH 14919*) with *S. bukasovii* (*OCH 11786*) and the unilateral crosses of this species with *S. phureja* (*OCH 15072*) were both highly successful, yielding an average of 100 to 350 seeds per berry, respectively.

79. *Solanum sawyeri* Ochoa, Am. Potato J. 58(12):649-652, illustr., 1981.

Figs. 379-381; Map 28.

Plant erect to erect-decumbent, 30-40 cm tall, glabrescent; stem usually simple, slender, 3-4 mm in dia. at base, very sparsely puberulent, slightly pigmented in the basal one-third of its length, very narrowly and inconspicuously straight winged, internodes 1-2 cm long. Stolons 1 m or more long and 2-3 mm in dia., white; tubers 1.5-3.0 cm long, ovoid, white. Leaves finely textured, smooth


5
4
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cm
HERBARIO OCHOA
Solanum sawyeri Ochoa Holotipo
PERU: Dept. Cuzco, prov. Urubamba, varios km al oeste de Ventapata, a unos 2300 m alt., en margenes de bosques. Febrero 20, 1960. C. Ochoa 2205 (holotipo).
Det. C. Ochoa

Figure 379. Plant and floral dissection of *Solanum sawyeri* (*Ochoa 2205*, holotype).

and delicate, short and broad, (10.0-)13.0-15.5 cm long by (5.5-)7.5-9.0 cm wide, imparipinnate, with 3-4 pairs of leaflets and 1-3 pairs of interjected leaflets, glabrescent above and somewhat puberulent only on the principal veins below. Terminal leaflet larger than the lateral leaflets, 5.0-6.5 cm long by 3.0-4.5 cm wide, broadly ovate, with pointed or shortly acuminate tips and rounded or subcuneate bases; lateral leaflets broadly ovate to elliptic, the first upper pair 2.5-5.5 cm long by 1.5-3.5 cm wide, with pointed or very shortly acuminate tips and obliquely rounded bases, subsessile or very shortly petiolulate, the lowermost pair of leaflets much smaller and sessile. Interjected leaflets

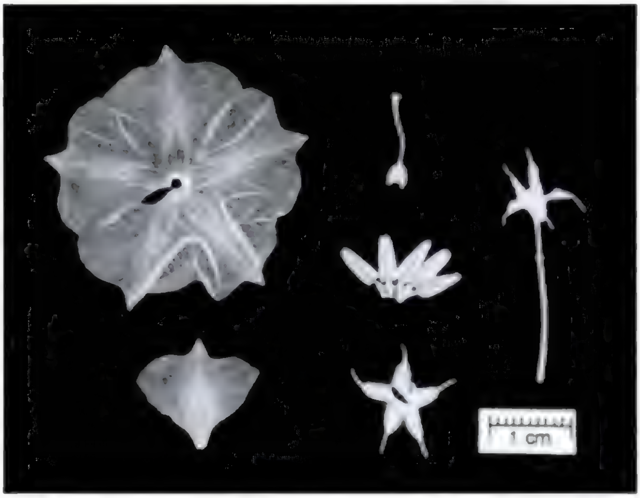


Figure 380. Floral dissection of *Solanum sawyeri* (*Ochoa 13698*).

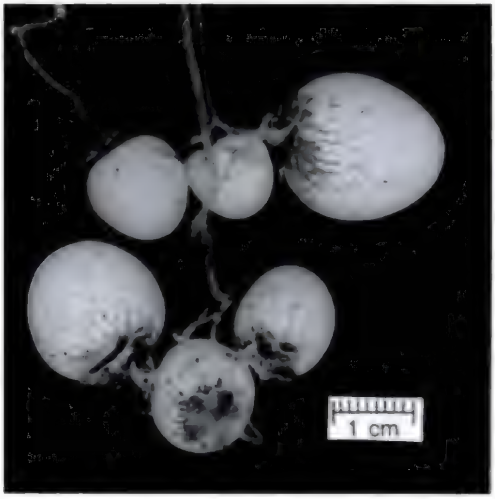


Figure 381. Fruits of *Solanum sawyeri* (*Ochoa 13698*).

broadly elliptic to ovate, sessile, very small, 1-2 mm long. Pseudostipular leaves broadly subfalcate or asymmetrically elliptic-lanceolate, up to 6 mm long by 3.5 mm wide. Inflorescence cymose, 4-5-flowered; peduncle short, 2-3 cm long, sparsely puberulent as in the case of the pedicels; pedicels 15-25 mm long, articulated 7-10 mm below the base of the calyx. Calyx symmetrical, dark green, sparsely pilose with very short white hairs, lobes elliptic-lanceolate, with attenuate or narrowly acuminate apices and pointed acumens, 1.5-2.0 mm long. Corolla rotate, 3.0-3.5 cm in dia., purple with a grayish-white internal star. Staminal column conic-truncate, asymmetrical; anthers narrowly lanceolate, 6-7 mm long; filaments 0.5-1.0 mm long, white hyalinous, glabrous. Style 9-10 mm long, exerted 2.5 mm, densely papillose along the lower two-thirds of its length; stigma ovoid. Fruit 2.5 cm long, ovoid or subglobose, green-glaucous, densely white or whitish-green dotted (Fig. 381). Chromosome Number: 2n=24. EBN=2.

Type: PERU. Department Cusco, Province Urubamba, a few km west of Vestapata, 2300 m alt., in forest clearings, February 1960, C. *Ochoa 2205* (holotype OCH, isotypes MOL, USM).

Affinities

This species is related to *S. sparsipilum*. The two have similar leaves, leaflets, calyces and pedicels. However, *S. sawyeri* differs markedly from that species in having slender stems; nearly glabrous vegetative parts; smooth, finely textured leaflets; rotate corollas with shorter, broader acumens; and, fruits of unusual color.

Habitat and Distribution

Solanum sawyeri grows in thickets and shrub forests of at the borders of moist, tropical tree forests, preferring loose soils that are very rich in humus.

This species is presently known only from the near vicinity of Vestapata in the Province of Urubamba, Department of Cusco, in southern Peru, where it occurs at elevations between 2300 and 2800 m (Map 28).

Specimens Examined

Department Cusco

Province Urubamba: A few km west of Vestapata, about 2300 m alt., along forest margins, fruits immature, ovoid, green-glaucous, 20 February 1960, C.

Ochoa 2205 (MOL, OCH USM, type collection of *S. sawyeri*). Along the foot trail from Aguas Calientes to Vestapata, ca. 2850 m alt., in dense, moist forests of trees and shrubs, very rare, only tubers were collected, 6 March 1980, *C. Ochoa 13698*, 2n=24 (CIP, OCH, plants grown in a field at Huancayo, propagated from the original tubers).

Breeding Potential

Reciprocal crosses of *S. sawyeri* (*OCH 13698*) with two diploid EBN=2 species, *S. bukasovii* (*OCH 13694, OCH 13747*) and *S. coelestispetalum* (*OCH 7711*), were successful. Similarly, success was had in unilateral crosses of this species with two accessions of another diploid, EBN=2 species, *S. raphanifolium* (*OCH 13572* and *OCH 13610A*).

80. *Solanum saxatilis* Ochoa, Phytologia 73(5):378-380, illustr., 1992.

Figs. 382-385; Map 28; Plate XXXV.

Plant robust, erect to erect-ascending, 50-80(-1.50) cm tall, sparsely pilose; stem simple or branched, triangular in cross-section, 1.5-1.8 cm in dia. at base, very sparsely puberulent, densely mottled with purple pigment along the basal two-thirds of its length, broadly straight or rarely sinuously winged, the latter also dark purple; internodes 3-7 cm long. Stolons up to 2 m long and 2-3 mm in dia.; tubers small, 1.5-3.0(-4.5) cm long, round to ovoid, white, with deep eyes and white-creamy flesh. Leaves (11-)18-25 cm long by (9.0-)12.8-17.0 cm wide, imparipinnate, with 3-4(-5) pairs of leaflets and 2-3 pairs of interjected leaflets. Leaflets narrowly elliptic-lanceolate or lanceolate, with pointed or shortly acuminate tips, dark green and very shortly and sparsely white pilose above with adpressed hairs, and lighter green and somewhat less pilose on the veins and veinlets below; rachis sparsely white pilose with somewhat longer hairs. Terminal leaflet nearly the same size as the upper lateral leaflets, (4.5-)7.2-8.0 cm long by (2.0-)2.5-3.0 cm wide, with narrow and long-attenuate bases,; leaflets of the first upper pair (4.0-)5.0-7.5 cm long by (1.3-)1.6-2.0 cm wide, with attenuate to obliquely rounded bases, sessile as in the case of the last upper pair, occasionally very narrowly decurrent about the rachis along the basiscopic side, the remaining lateral leaflets shortly petiolulate, on pigmented petiolules 1.0-1.5(-3.0) mm long. Interjected leaflets suborbicular to subelliptic, 2-10 mm long, sessile. Pseudostipular leaves reniform or broadly falcate and auriculate, usually large, 10-14(-20) by 6-8(-12) cm long. Inflorescence cymose or cymose paniculate, 10-15(-30)-flowered; peduncle 8-10(-14) cm long, slender, 1.5-2.5 mm in dia. at the

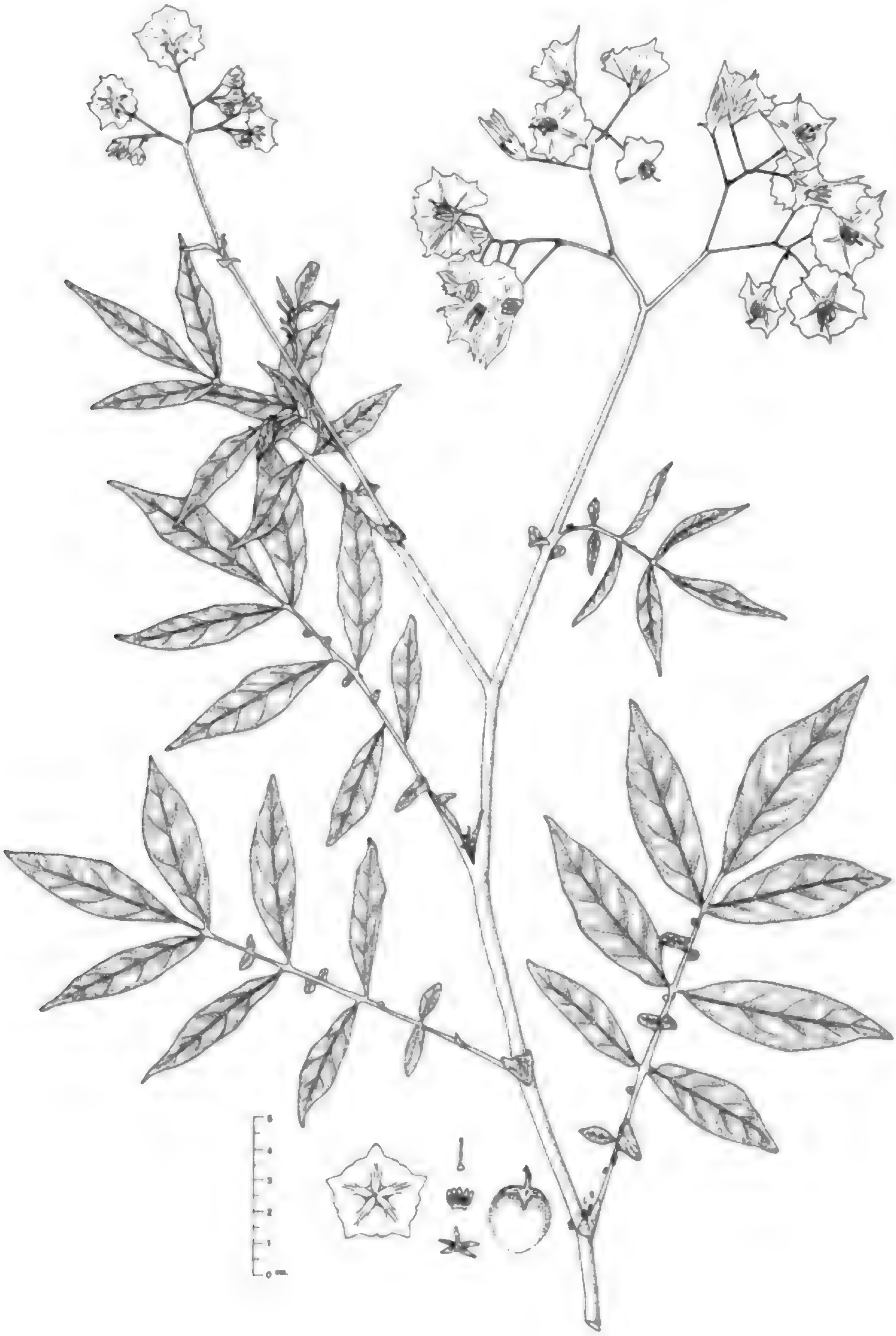


Figure 382. Plant, floral dissection and fruit of *Solanum saxatilis* (*Ochoa 15082*, holotype).

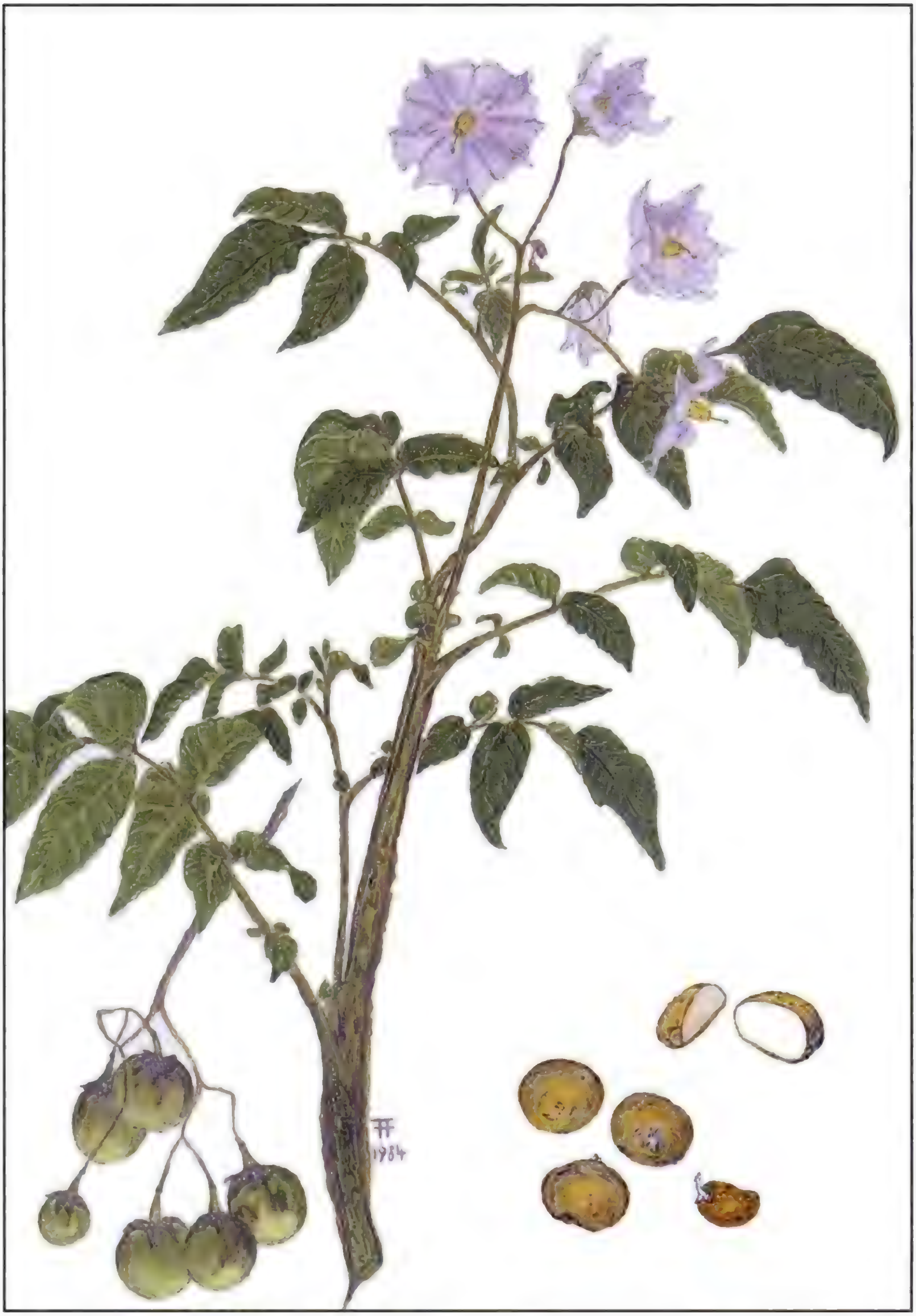


Plate XXXV. *Solanum saxatilis* Ochoa.

base, forked or biforked, pubescent with very short hairs, pigmented as in the case of the pedicels and the calyx; pedicels 15-20 mm long, articulated 3-4 mm below the base of the calyx. Calyx symmetrical, small, 5.5 mm long, with elliptic-lanceolate lobes abruptly narrowed to pointed acumens, the latter 1.0-1.5 mm long. Corolla rotate, small, 2.5-2.8 cm in dia., light violet or dark lilac, with a grayish-yellow internal star. Staminal column cylindric-conical, asymmetrical; anthers 5.5-5.5 mm long, narrowly lanceolate, with cordate bases; filaments 1.0-1.5 mm long, white-hyalinous, glabrous. Style 8.5-9.0 mm long, exerted 1.5-2.0 mm, densely papillose along the basal one-third of its length; stigma small, slightly enlarged at the apex of the style, light green; ovary round to ovoid. Fruit ovoid, to 25 mm long, with an obtuse or rarely round light green apex, the basal end dark green and flushed with a tinge of lilac. Chromosome Number: 2n=24. EBN=2.

Type: PERU. Department Puno, Province Sandia, near Kkakkapata, ca. 3550 m alt., on cliffs in damp rocky soils within a moist quebrada and on steep slopes, scarce, 19 February 1983, *C. Ochoa and A. Salas 15082* (holotype OCH, isotypes CIP, MO, MOL).

Paratype: PERU. Department Puno, Province Sandia, Pucpuquipata, ca. 3650 m alt., near Kkakkapata, 2 km east of Janahuaña, in moist soils and at base of a rocky cliff, 4 March 1984, *C. Ochoa and A. Salas 15606* (CIP, MO, MOL, OCH, USM).

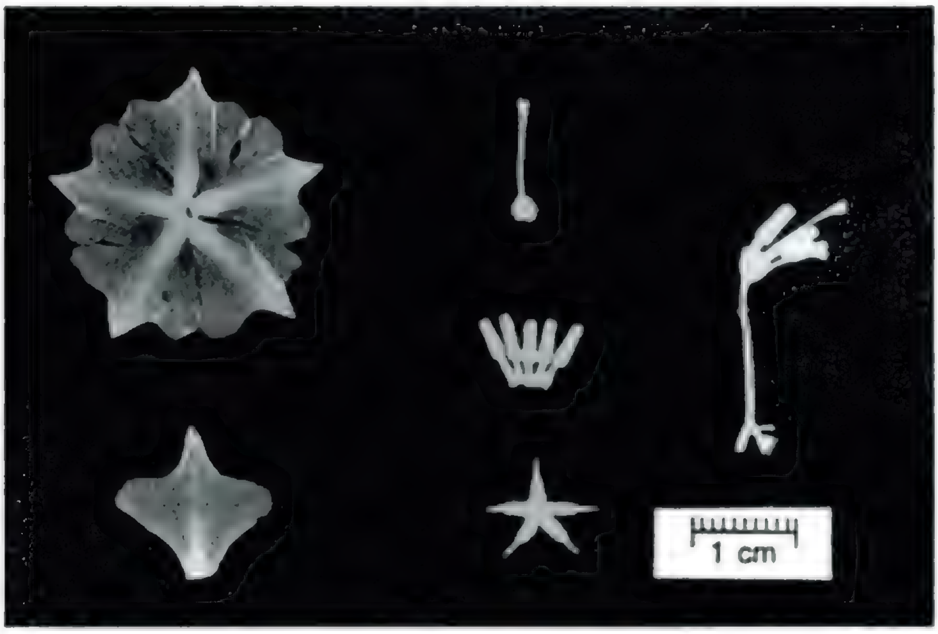


Figure 383. Floral dissection of *Solanum saxatilis* (*Ochoa 15082*, holotype).

Affinities

This species is related to *S. bukasovii* but differs in several important respects, including its larger, more robust stems (these never rosette-forming); smaller, more rotate corollas; less dissected leaves; and, pointed or acuminate lanceolate leaflets.

Habitat and Distribution

Solanum saxsatilis has been collected in narrow, moist, cool quebradas, high *puna* lands and at the base of rocky cliffs at elevations between 3500 and 3650 m. It grows in *Stipa ichu* grasslands in moist, organically rich, rocky soils or between the crevices of rocks. In the *puna* lands it is associated with *Astragalus* sp., *Duranta rupestris*, *Lupinus* sp. and *Saracha biflora*. It is known to occur with a tall tufted *Cortaderia* species (=Nihua) on the slopes of escarpments.

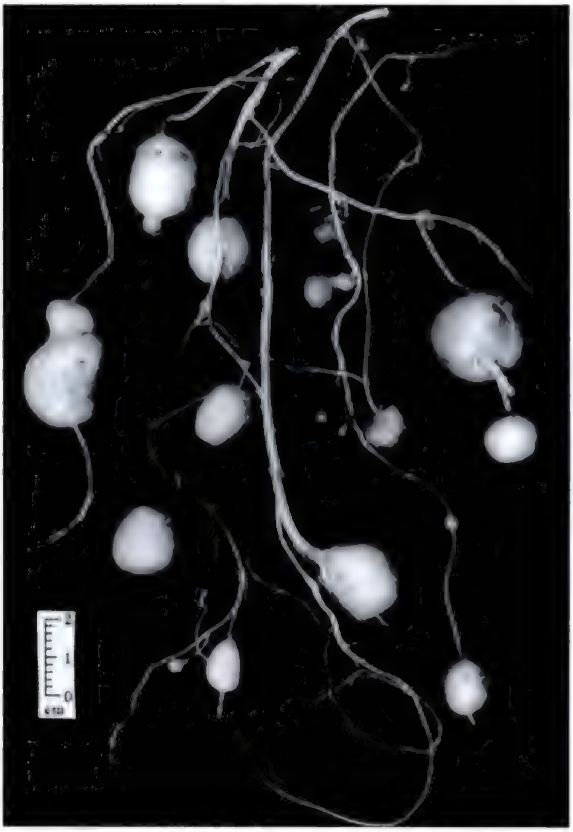


Figure 384. Tubers of *Solanum saxatilis* (*Ochoa 15606*), collected at Puno, August 1984.

This species is endemic to the vicinity of its type locality in the Province of Sandia, Department Puno, in southern Peru (Map 28).

Specimens Examined

Department Puno

Province Sandia: Kkakkapata, ca. 3500 m alt., on steep talus slopes and in moist, gravelly soils, near large boulders, in a moist quebrada, associated with *Stipa ichu*, *Duranta rupestris*, *Saracha biflora* and *Verbena* sp., 19 February 1983, *C. Ochoa and A. Salas 15082* (CIP, MO, MOL, OCH, type collection of *S. saxatilis*). Pucpuquipata, ca. 3650 m alt., near Kkakkapata, 2 km east of Janahuaña, in moist soil near cliffs and rocky bluffs with *Cortaderia* sp. with an understory of ferns and grasses, 5 March 1984, *C. Ochoa and A. Salas 15606* (paratypes CIP, MO, MOL, OCH, USM).

Breeding Potential

The results of crosses of *S. saxatilis* with diploid species (2n=24) of EBN=1 and tetraploid species (2n=48) of EBN=4 are given in Table 96, while the materials used in these experiments are shown in Table 97.

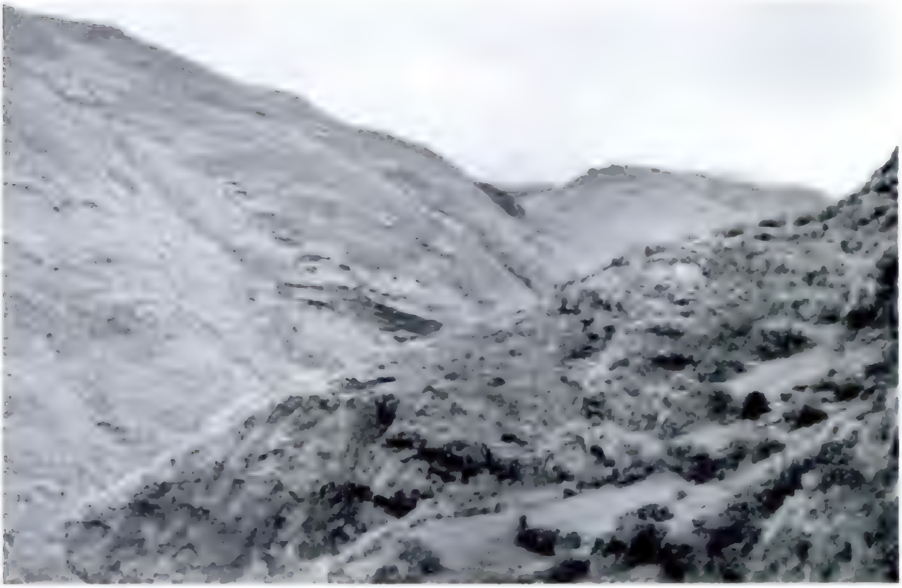


Figure 385. Pucpuquipata, 3700 m alt., about 4 km (air distance) from Patambuco, type locality of *S. saxatilis*, associated with *Stipa ichu* and *Cortadería* sp., Sandia, Puno.

Although reciprocal crosses of *S. saxatilis* with plants of *S. candolleanum* (EBN=2) of the Series Tuberosa were often very successful, no luck was had in reciprocal crosses of this species with *S. huarochiriense* of the same EBN value and taxonomic series. Similarly, reciprocal crosses between this species and two EBN=2 species of the Series Conicibaccata, *S. chomatophilum* and *S. urubambae*, gave opposing results, although the yields that were obtained from the single compatible species (*S. chomatophilum*) were much smaller in this case. Lastly, no seed was obtained at all in the unilateral crosses involving *S. saxsatilis* and the cultivated *S. tuberosum* subsp. *andigena*.

Table 96. Fertility of *Solanum saxatilis* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	2	CONICIBACCATA	× *S. chomatophilum*	25(39)	24(23)	8(5)
			× *S. urubambae*	3(7)	0(0)	0(0)
24	2	TUBEROSA	× *S. candolleanum*	1(14)	1(8)	30(119)
			× *S. huarochiriense*	2(19)	2(13)	0(0)
48	4	TUBEROSA	× *S. tuberosum* subsp. *andigena*	4	0	0

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 97. Collections (OCH) used in *Solanum saxatilis* fertility studies.

CONICIBACCATA	TUBEROSA
S. chomatophilum 11061, 13198, 13199, 14786, 14824	*S. candolleanum* 14990, 15004, 15011, 15023, 15024
S. urubambae 13778, 13779	*S. huarochiriense* 14525
	S. saxatilis 15082
	S. tuberosum subsp. *andigena* 15039

81. *Solanum scabrifolium* Ochoa, Darwiniana 17:427-429, illustr., 1972.
Fig. 386-388; Map 21.

Plant erect to laxly-erect or erect-decumbent, sparsely pilose; stem simple or branched (branches, when present, extending laterally), 4-8 mm in dia. at base, pigmented, subglabrous or sparsely pilose, without wings or very narrowly straight winged; internodes (1.5-)2.5-5.0 cm long. Stolons 50-60 cm long, very slender, 1-2 mm in dia.; tubers small, 1-2 cm long, round to ovoid, white. Leaves thick, scabrous, coriaceous or subcoriaceous, 7-10(-14) cm long by 5-7(-8) cm wide, light green and somewhat shiny above and green or slightly pigmented pale violet below; leaves imparipinnate with 4-5 pairs of leaflets and 0-2 pairs of interjected leaflets; leaflets sparsely pilose, hairs short and coarse above, pilose only on the veins and veinlets below, the leaflet margins entire or minutely subcrenulate. Terminal leaflets broadly ovate, with pointed tips and rounded bases, somewhat larger than the adjacent lateral leaflets, 2.5-6.0 cm long by 2.0-3.5 cm wide; lateral leaflets elliptic-lanceolate or narrowly ovate-lanceolate, with pointed to subobtuse tips and symmetric or asymmetrically rounded bases, sessile or subsessile; base of the leaflets of the first upper pair usually somewhat more noticeably decurrent about the rachis. Interjected leaflets, when present, very small, 1-5 mm long, orbicular, ovate or elliptic, sessile. Pseudostipular leaves falcate or slightly clasping, 5-12 mm long by 3-7 mm wide. Inflorescence cymose to cymose-paniculate, 4-25 flowered; peduncles short, 3-5 cm long, pigmented and sparsely pubescent; pedicels 20-35 mm long, more densely pubescent, articulated in the upper one-third of its length or 7-9 mm below the base of the calyx. Calyx symmetrical, 7-8 mm long; lobes narrowly elliptic-lanceolate with membranous margins at base, abruptly acuminate, acumens pointed or subspatulate, 2-3 mm long. Corolla rotate, 2.5-3.0 cm in dia., purple with a whitish star forming a border that extends from the acumen to the base of each petal; petals broad, with small acumens and densely puberulent apex. Staminal column subcylindrical-conical; anthers broadly lanceolate, 5.0-5.5 mm long, with cordate bases; filaments short, 1 mm long, white-hyalinous, glabrous. Style 9-10 mm long, exerted 4-5 mm, glabrescent or papillose along the lower two-thirds of its length; stigma capitate, small and cleft. Fruit round, light green to green-glaucous, 1.0-1.5 cm in dia. Chromosome Number: 2n=24.

Local Names: The plant is called *Purun Papa* and the fruit or berry is termed *Shuructa*.

Type: PERU. Department Huánuco, Province Huamalíes, vicinity of Pincullo, 2940 m alt., 22 April 1967, C. *Ochoa 2633*, 2n=24 (holotype OCH, plants grown at the Univ. Nac. Agr. La Molina, Lima).

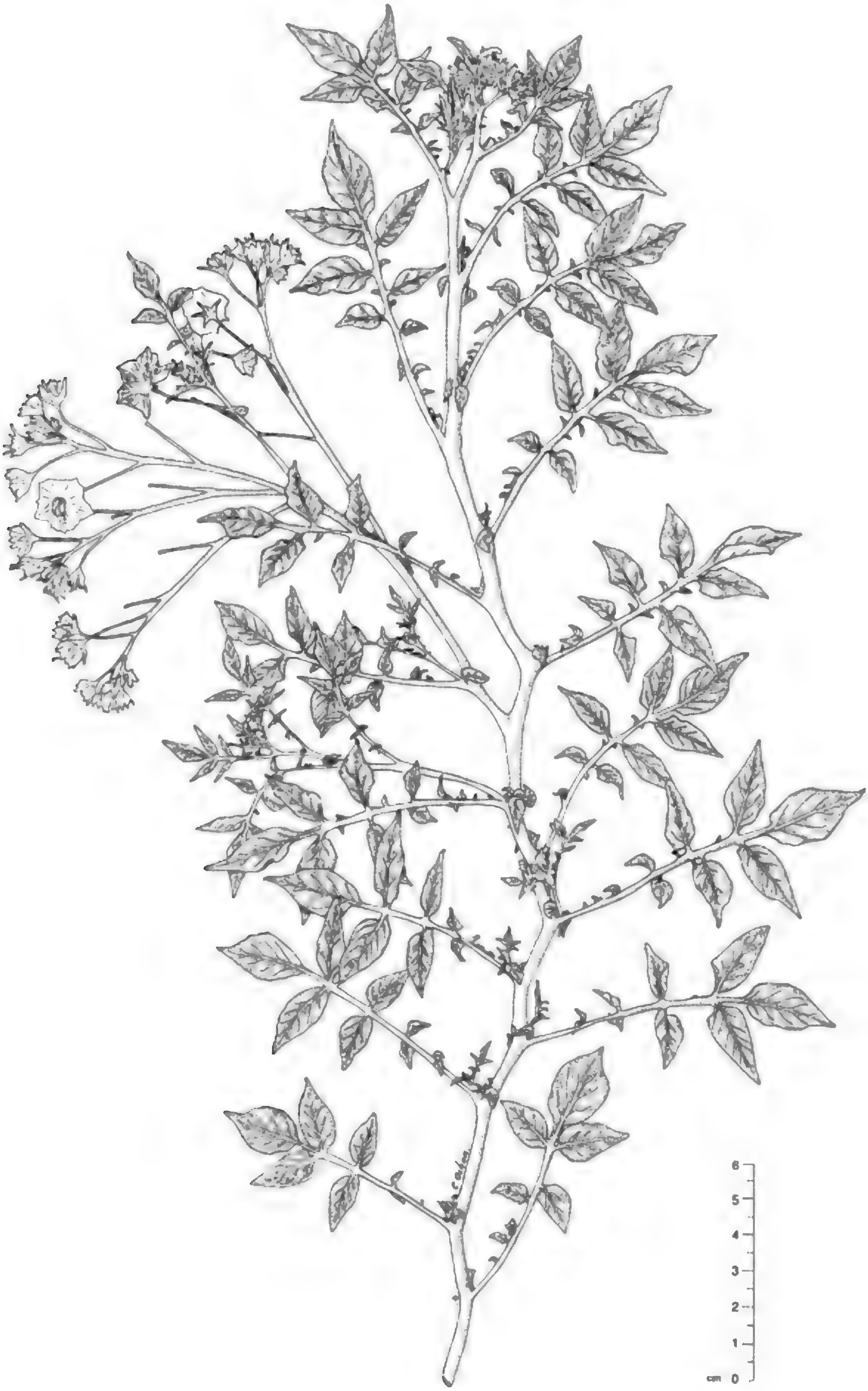


Figure 386. *Solanum scabrifolium* (*Ochoa 2633*, holotype).

The original diagnosis of *S. scabrifolium* was based solely on plants propagated at the Univ. Agr. La Molina, near Lima. However, the author was later able to verify the range of variability of this species under natural conditions following his second visit to the type locality. These later observations were helpful in interpreting the original set of collections from this region, including Nos. *2632*, *2633*, *2634* and *2635*. Moreover, some taxonomic insight into this species was gained from a study of the living and dried collections of this wild potato that are maintained at the U.S.D.A. germplasm center at Sturgeon Bay, Wisconsin, as well as from the living and dried collections of this species that are maintained at CIP-Huancayo and CIP's headquarters at La Molina, Lima.

Affinities

This species has some characteristics in common with both *S. chiquidenum* and *S. chomatophilum*. It is similar to *S. chiquidenum* in having thick, scabrous leaflets that have ciliate or crenulate margins. Moreover, the calyces of *S. scabrifolium* and *S. chiquidenum* are very similar in appearance, and both have their pedicels articulated at relatively the same points.

Features that are shared by this species and *S. chomatophilum* include the narrowly decurrent leaflets that appear somewhat shiny on their upper surfaces but are pigmented light lilac below.

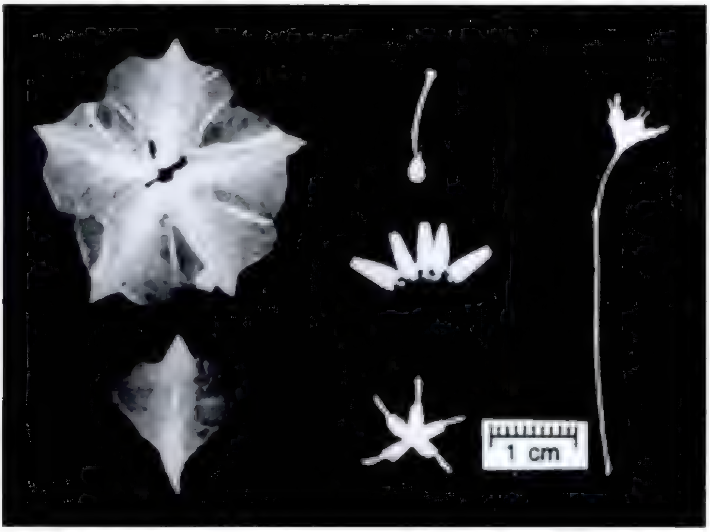


Figure 387. Floral dissection of *Solanum scabrifolium* (*Ochoa 2635*).

Habitat and Distribution

Solanum scabrifolium grows in interandean quebradas at elevations between 2800 and 3300 m. It occurs primarily in lateritic soils in subxerophytic zones. It has been collected in several areas of its range growing with *Agave americana*, *Lantana* sp., *Dodonea viscosa*, *Schinus molle*, *Caesalpinia spinosa*, *Cortaderia rudiuscula*, *Alonsoa*, *Salvia biflora*, *Salvia coerulea* and *Bidens* sp.

This species is known only from the Provinces of Dos de Mayo and Huamalíes in the Department of Huánuco in northern Peru (Map 21).

Specimens Examined

Department Huánuco

Province Dos de Mayo: District Quivilla, on the lower slopes of Cerro Intipunco, 2800 m alt., near the base of the natural façade of Cerro Intipunco, facing Culquish, leaves coriaceous, 22 April 1967, *C. Ochoa 2632*, 2n=24 (OCH).

Province Huamalíes: Vicinity of Pincullo, 2940 m alt., very rare, only berries and tubers were collected, 22 April 1967, C. *Ochoa 2633* (OCH, type collection of *S. scabrifolium*, from plants grown at the Univ. Nac. Agr. La Molina, Lima). Pincullo, 3000 m alt., near Morca, 22 April 1967, C. *Ochoa 2634*, 2n=24 (OCH). Lower slopes of Cerro Llacuy, near Huergá, 3340 m alt., between Taricay and Playa, past Cochapata, in dense shrubby thickets, at the foot of the waterfall

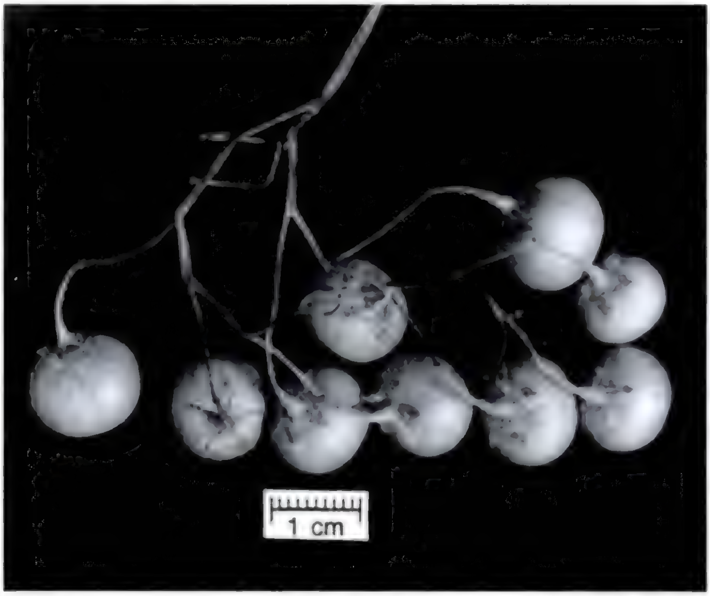


Figure 388. Fruits of *Solanum scabrifolium* (*Ochoa 2635*).

that descends from a rocky slope, 22 April 1967, *C. Ochoa 2635*, 2n=24 (MOL, OCH, USM). Foothills of Cerro Llacuy, near Llata, 3300 m alt., only mature berries and poor leaf fragments were collected, 22 April 1967, *C. Ochoa S-60*, 2n=24 (OCH), (CIP, OCH, plants propagated in the greenhouse at Huancayo in April 1988 from seed sent from the U.S.A., No. *PI-365363*, =*Och. S-60*) and (CIP, MOL, OCH, plants grown from the same number, *PI-365363*, in the CIP greenhouse at La Molina in June 1988).

82. *Solanum sparsipilum* (Bitt.) Juz. et Buk. ap. Bukasov, in N.I. Vavilov. Theor. Bases Pl. Breed 3:11, 1937.

Figs. 389-394; Map 30.

S. tuberosum L. subsp. *sparsipilum* Bitt., Repert. Sp. Nov. 12:152-153, 1913. Type: BOLIVIA. Department La Paz, [Prov. Murillo], Obrajes, near La Paz, 26 January 1907, *Buchtien 771* (E, G, MO, US).

S. aracc-papa Juz., Bull. Acad. Sci. U.S.S.R. ser. Biol. 2:306-307. 1937. Type: PERU. Department and Province of Cusco, Cerro Huilcacalle, near Villa de San Sebastián, not far from Cusco, tubers collected 1 August 1927, *Juzepczuk 1455* (WIR, from plants grown near Leningrad, U.S.S.R.).

S. catarthrum Juz., Bull. Acad. Sci. U.S.S.R. ser. Biol 2:307-308. 1937. Type: PERU. Department Cusco, collected only tubers at the Hacienda Lucre, near Cusco, 18 November 1932, *Kauffman s.n.* (WIR, No. *K-20*, from plants grown near Leningrad, U.S.S.R.).

S. anomalocalyx Hawkes, Bull. Imp. Bur. Pl. Breed. and Genet., Cambridge 52, 126-127, Fig. 42. 1944. Type: BOLIVIA., Department Cochabamba, Province Cercado, near Cochabamba, 14 March 1939, *Balls, Gourlay and Hawkes 6222* (BM, CPC, K, US).

S. brevimucronatum Hawkes, Bull. Imp. Bur. Pl. Breed. and Genet., Cambridge 52:127, Fig. 43. 1944. Type: BOLIVIA. Department La Paz, Obrajes near La Paz, 28 January 1939, *Balls, Gourlay and Hawkes 5890* (CPC); Paratype: BOLIVIA. Calacoto, Valle de Obrajes, near La Paz, 28 January 1939, *Balls, Gourlay and Hawkes 5895* (CPC, UC, US).

S. calcense Hawkes, Bull. Imp. Bur. Pl. Breed. and Genet., Cambridge 53, 128-129, Fig. 46. 1944. Type: PERU. Department Cusco, Province Calca, Hacienda Urco, 3350 m alt., near Calca, 11 May 1939, *Balls and Hawkes 6744* (CPC, plants grown in field at Edinburgh, Scotland).

S. lapazense Hawkes, Bull. Imp. Bur. Pl. Breed. and Genet., Cambridge 52:127-128, Fig. 44. 1944. Type: BOLIVIA. Department La Paz, Below La Paz, 29 January 1939, *Balls, Gourlay and Hawkes 5903* (CPC, K).

S. anomalocalyx var. *brachystylum* Cárdenas and Hawkes, Jour. Linn. Soc., Bot.

53:105. 1945 (as var. *brachystyla*). Type: BOLIVIA. Department Cochabamba, Province Cercado, La Maica, February 1944, *Cárdenas 3519* (CPC).

S. anomalocalyx var. *llallaguanianum* Cárdenas and Hawkes, Jour. Linn. Soc., Bot. 53:104-105, 1945. Type: BOLIVIA. Llallaguani, Department Cochabamba, Province Tarata, near Anzaldo, 2900 m alt., January 1944, *Gandarillas s.n. = Cárdemas 3508* (CPC), and near la Angostura, 2550 m alt., February 1944, *Cárdenas 3518* (CPC cotype).

S. anomalocalyx var. *murale* Cárdenas and Hawkes, Jour. Linn. Soc., Bot. 53:106, 1945 (as var. *muralis*). Type: BOLIVIA., Department Cochabamba, Province Cercado, La Maica, March 1944, *Cárdenas 3507* (CPC).

S. calcense var. *urubambae* Vargas, *Las Papas Sudperuanas*, Part II (Publ. Univ. Nac. Cusco):57, Fig. 9. 1956 (as var. *urubambense*). Type: PERU. Department Cusco, Phiri, [Prov. Urubamba], *Vargas C. 9824* (CUZ, LL, MO).

S. membranaceum Vargas, *Las Papas Sudperuanas*, Part II (Publ. Univ. Nac. Cusco): 62, Fig. 20. 1956. Type: PERU. Department Cusco, Province Urubamba, Pumahuanca, *Vargas C. 7595* (CUZ, OCH).

S. sparsipilum var. *llallaguanianum* (Card. and Hawkes) Correll, in Correll *The Potato and its Wild Relatives*, Renner, Texas, p. 465. 1962. Type Collection: The same as *S. anomalocalyx* var. *llallaguanianum*).

S. ruiz-zeballosii Cárdenas, Rev. de Agricultura, Cochabamba 11:13-14, Fig. s.n.. 1968. Type: BOLIVIA. Department Cochabamba, Province Cercado, Las Cuadras, February 1966 *Cárdenas* 6229 (CA).

S. sparsipilum subsp. *sparsipilum* Hawkes, in *The Potato. Evol., Biodiv., and Genet. Resour.*, London, 169, 1990.

S. sparsipilum subsp. *calcense* Hawkes, in *The Potato. Evol., Biodiv., and Genet. Resour.*, London, 169-170, 1990.

Plant erect to erect-ascending, occasionally decumbent, robust, leafy, (30-)50-70(-120) cm tall, sparsely pilose; stem slightly flexuous, glabrescent, usually branched, vigorous, 6-10(-12) mm in dia. at base, slightly pigmented, wings straight, 1-2 mm wide, internodes (1.5-)2.5-5.0(-7.0) cm long. Stolons up to 2 m or more long; tubers white, round to ovoid, occasionally slightly compressed, 1.5-3.0(-5.0) cm long. Leaves somewhat flaccid, (7-)12-27(-33) cm long by (4-) 7-16(-19) cm wide, rugose, dark green, sparsely pubescent with short coarse hairs above and light green and less pilose below; leaves imparipinnate with 3-4(-5) pairs of lateral leaflets and (0-)3-7 pairs of interjected leaflets, less frequently with 6 pairs of leaflets and up to 20 pairs of interjected leaflets. Leaflets ovate to ovate-elliptic or broadly elliptic to elliptic-lanceolate, obtuse and pointed or very shortly acuminate at apex and obliquely rounded to cuneate or subcordate at base, subsessile or petiolulate, 6-10 mm long. Terminal leaflets broadly elliptic-lanceolate or broadly ovate, with pointed or shortly acuminate (or very rarely obtuse) tips and usually rounded to cuneate (or rarely cordate) bases, very narrowly decurrent about the rachis, slightly larger than the adjacent lateral leaflets, (3-)4-9(-11) cm long by (1.5-)2.5-5.5(-6.8) cm wide. Lateral leaflets of the first and second upper pairs nearly equal in size, 3.5-6.0 (-8.5) cm long by 2.0-3.5(-4.5) cm wide; leaflets of the lowermost pairs considerably smaller. Interjected leaflets orbicular to ovate, varying in size, 1-12 mm long, more or less sessile. Pseudostipular leaves broadly falcate, to 18 mm long by 9 mm wide. Inflorescence cymose or cymose-paniculate, (4-)8-16(-20)-flowered; peduncle (2-)4-8(-12) cm long, slightly pigmented, sparsely pilose as in the case of the pedicels; pedicels 15-25(-30) mm long, slender, 1-2 mm in dia.; articulated above center or in the upper one-third of their length, or about 7-12 mm below the base of the calyx. Calyx symmetrical or asymmetrical, densely pubescent, 5.5-6.5(-8.0) mm long, lobes broadly ovate-lanceolate or round, with mostly acuminate tips, acumens pointed, filiform, 1.0-1.5 mm long, rarely apiculate. Corolla rotate-pentagonal to rotate, acumens 2.5-4.5(-6.0) mm long,

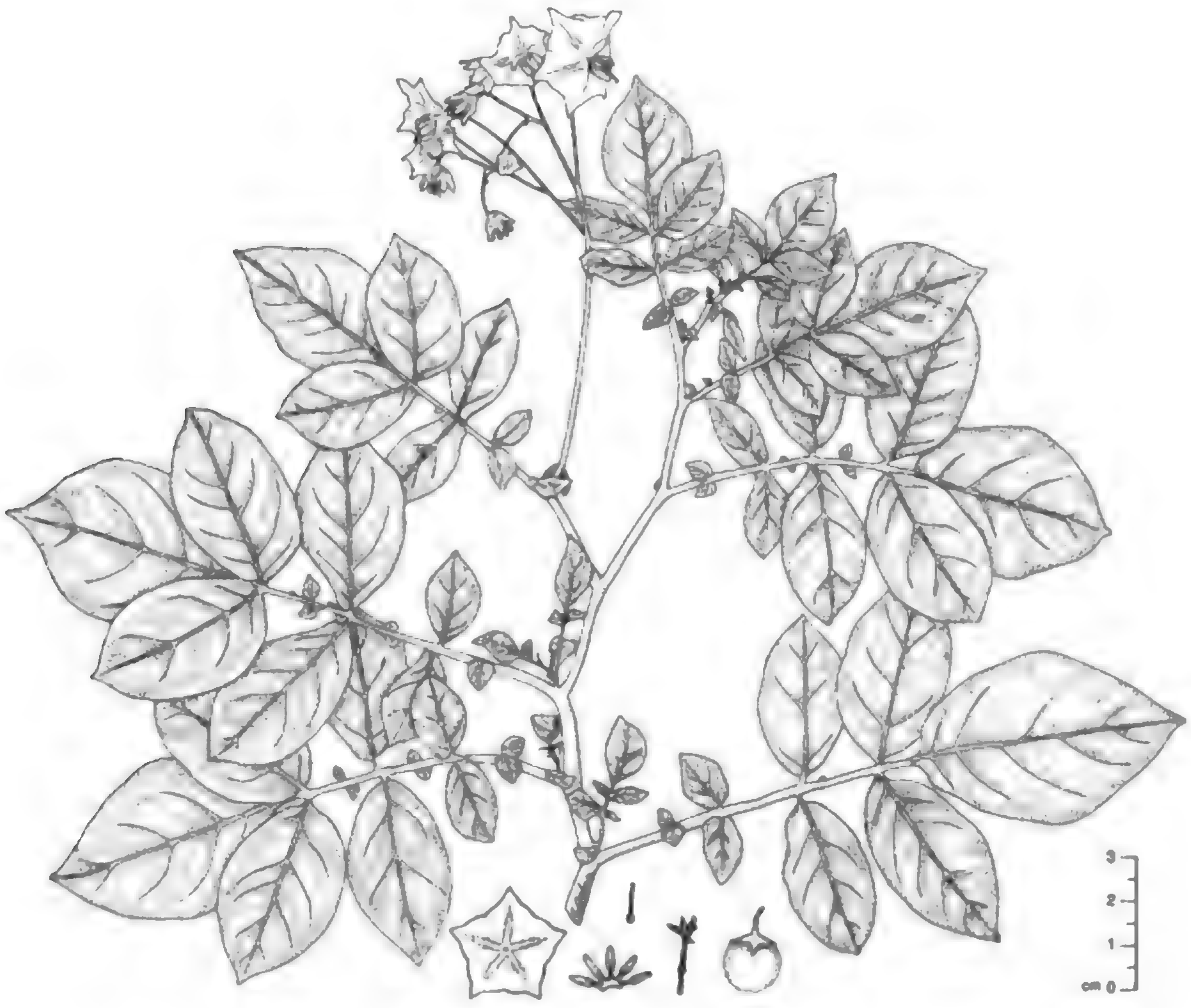


Figure 389. *Solanum sparsipilum* (*Ochoa 7611*).

pale blue-violet or very deep purple, less frequently blue or whitish, 2.6-3.0 cm in dia. Anthers broadly lanceolate, 5.0-6.5 mm long by 1.5-2.5 mm wide at base. Style 9-13 mm long, exerted up to 4 mm, subglobose or shortly papillose at the midpoint or in the basal one-third of its length; stigma thick, shortly capitate, cleft. Fruit round to ovoid, 1.5-2.0 cm in dia., green, marked with deep violet vertical stripes and speckled with white dots, not verrucose. Chromosome Number: 2n=24. EBN=2.

Local Names: The plant is called *Apharuma* in Calacoto, La Paz, Bolivia; *Atokk Papa*, in San Sebastián, Cusco; and, *Arakk Papa or K'ita Papa* in Cusco, Peru. The fruit is called *Mamarco* or *Ckucari* in the Province of Carabaya, Puno.

Type: BOLIVIA. La Paz, on slopes of a mountain, 3800 m alt., 26 January 1907, *O. Buchtien 771 p.p.* (lectotype US).

At the time when Bitter described his *S. tuberosum* subsp. *sparsipilum*, he intimated that he might change its taxonomic rank when more material of this entity became available for study. In effect, this was done in 1937 when Juzepczuk and Bukasov proposed the species *S. sparsipilum*.

This species, widely distributed in nature, is extremely variable, especially in the pubescence of the plant, the shape and dissection of the leaves and the size, shape and color of the corolla. These variations in the morphology of the plant have induced taxonomists in the past to describe a multitude of segregate species and minor variants that have not fared well in the light of our more modern and conservative concepts of species (*cf.* Ochoa, 1990). An example of such is *S. aracc-papa*, which was described in 1927 by Juzepczuk from tuber specimens collected at Cerro Huilcacalle (this facing San Sebastián), near Cusco. Unfortunately, no herbarium specimens of the original plant were at that time obtained from nature, although tubers from these plants were later sown near Leningrad, Russia. Plants grown from the original tubers were made into the herbarium specimens that are currently housed at WIR. One of the specimens examined by author, *Juzepczuk 1455*, corresponds very closely to the description made by Juzepczuk and should probably be considered as the holotype. Another tuber collection made by Juzepczuk (No. *1190*), bearing the designation *S. aracc-papa*, came from the same locality as the first, and was grown out and harvested near Leningrad on the 30th of October, 1929. In the opinion of the present author, both collections represent naturally-occurring variants of *S. sparsipilum*.

In the author's 1990 treatment of the Bolivian wild species of potato, a lectotype for *S. sparsipilum* was proposed which was based on a Buchtien collec-

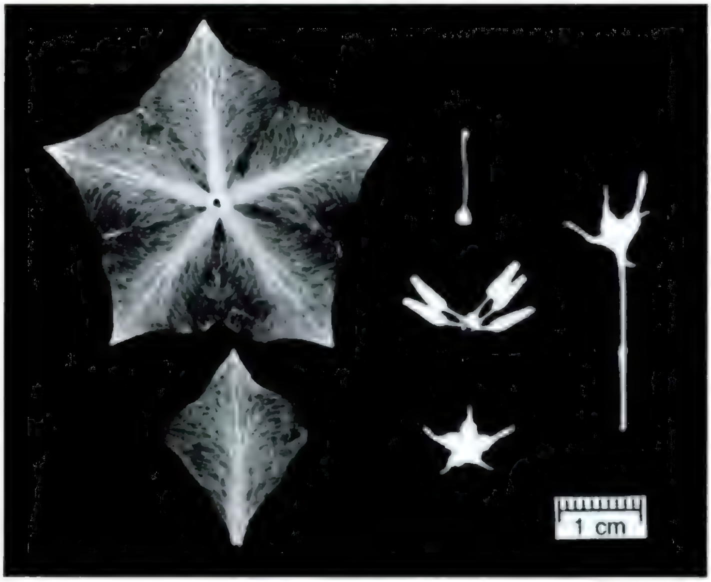


Figure 390. Floral dissection of *Solanum sparsipilum*, Urubamba, Cusco (*Ochoa 8358*).

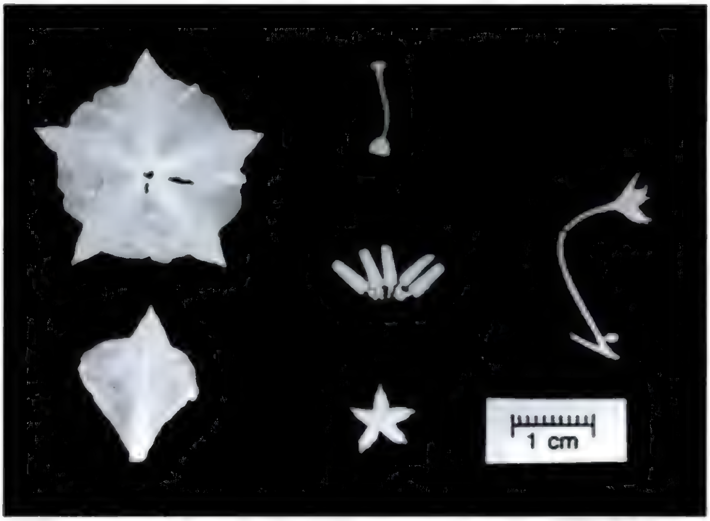


Figure 391. Floral dissection of *Solanum sparsipilum*, Huilcarpay, Cusco (*Ochoa 13708*).

tion (No. *771*) housed in the U. S. National Museum (US). However, unknown to the author at the time was the fact that Hawkes and Hjerting (1989) had proposed the very same collection of Buchtien as the lectotype for *S. sparsipilum* in the previous year. Moreover, as correctly pointed out by Hawkes and Hjerting, there actually exist two collections by Buchtien that bear the number *771*. These specimens were collected by him at two localities in two different altitudinal zones, and on two different dates. One specimen, the US lectotype of *S. sparsipilum* (*Buchtien 771 p.p.*), was collected from the slopes or hillsides of a mountain at an elevation of 3800 m on January 26, 1907, while the remaining specimens (*Buchtien 771 p.p.*), today found in herbaria at Edinburgh (E), Geneva (G) and Missouri (MO), were collected below Obrajes, La Paz, at an elevation of 3350 m on February 17, 1932. Bitter also indicated the presence of other specimens of *S. tuberosum* subsp. *sparsipilum* at the herbarium of Breslau in Poland. Unfortunately, these are no longer extant and appear to be lost.

Fewer variations in leaf dissection and in the shape and size of the leaflets are to be noted amongst plants of *S. sparsipilum* that are grown under controlled experimental conditions. The leaflets of field grown plants, for example, are rarely as broadly ovate or as cordate or subcordate at the base as they do sometimes appear to be under natural conditions.

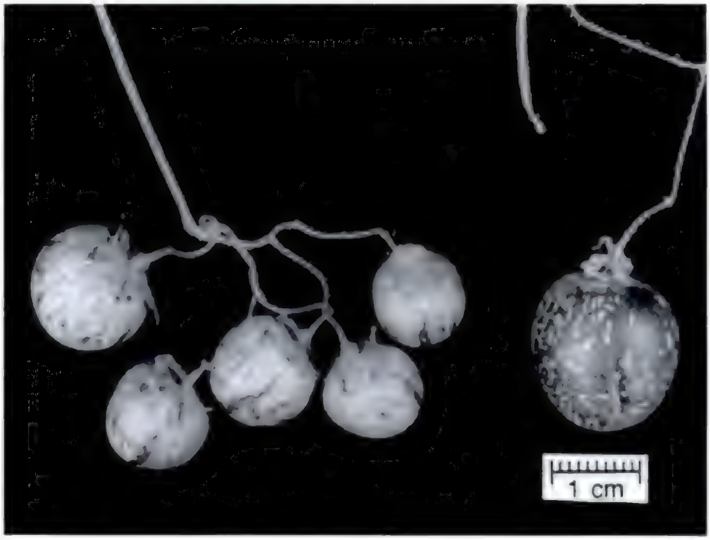


Figure 392. Fruits of *Solanum sparsipilum*, collected at Acomayo *(Ochoa 7611)*.

Affinities

From the time of Bitter's 1913 description of this entity to the present time, *S. sparsipilum* has been considered to be closely related to the cultivated potatoes. Hawkes (1956) suggests this species is ancestral to *S. tuberosum*; whereas, Ugent (1970) believes this predominantly weedy species has originated in crosses between the diploid cultivated potatoes and *S. canasense* of the *S. brevicaule* complex, and is thus of stabilized hybrid origin. More recently, Cribb and Hawkes (1986) have proposed that *S. tuberosum* subsp. *andigena* originated in a chromosomally doubled cross involving the cultivated *S. stenotomum* (2n=24) and the wild (or weedy) *S. sparsipilum*.

With respect to its relationship with other wild species of potato, *S. sparsipilum* appears to be closest to *S. sawyeri*. The two are similar with respect to plant habit, leaf shape and dissection, and in having slender peduncles and pedicels. *Solanum sparsipilum* differs principally in having leaves that are finer, less rugose, and less pilose or subglabrous than those of *S. sawyeri*, and in having consistently purple corollas and green-glaucous fruits that are densely white speckled.

Solanum sparsipilum also shows some affinity to *S. bukasovii*. However, it differs from that species in having a taller, non-rosette forming stem, longer internodes, more sparsely pilose leaves, shorter, slenderer and less pubescent peduncles, lower pedicel articulations and calyces of different size and appearance.

Hawkes and Hjerting (1989, p. 341) suggest this species is related to *S. leptophyes* and *S. brevicaule*. However, while these two last mentioned species are undoubtedly closely related to one another, they appear, to the present author, at least, to be extremely different from *S. sparsipilum*.

Habitat and Distribution

This predominantly weedy species is common to Peru and Bolivia. It is found usually within cultivated fields of maize or other crops, where it is called *Arakk Papa* by the farmers. However, it has also been collected from the edges of trails and brooks, temperate valleys, subxerophytic quebradas and cool, remote *puna* and *prepuna* regions that are far from human habitations, as well as from the grounds of cemeteries, where it is known locally as *Atokk Papa* or *K'ita Papa*. As might be expected from its wide range of habitat choices, this species tolerates a variety of edaphic conditions, ranging from growth in gravelly, sandy or sandy-clay soils to soils that are rich in organic materials. It appears to grow equally well on stone or earthen walls as it does in open fields or shrubby areas. It has been collected in various parts of its range growing in moist thickets comprised of various herbaceous plant genera, including *Brassica*, *Poa*, *Urtica*, *Calceolaria*, *Verbena*, *Polygonum*, *Galinsoga*, *Rumex*, *Eragrostis*, *Ipomea*, *Oxalis* and *Solanum* (non tuber-bearing species). In some areas of its range, the species grows frequently in close association with *Solanum raphanifolium*; whereas in other areas it may occur with either *S. marinasense* or *S. bukasovii*, but not as commonly. It has also been collected growing under the shade of various subxerophytic mountain shrubs, including *Nicotiana*, *Agave*, *Buddleja*, *Cortaderia*, *Mutisia*, *Tecoma*, *Croton*, *Trichocereus* and *Puya*, as well as trees such as *Schinus*, *Cassia*, *Escallonia* and *Eugenia*.

This species usually occurs between 2500 and 3200 m altitude in Peru, although in certain locations individuals growing at elevations of 4200 m have been recorded. Of the 150-odd collections of this species that were examined by the author, 134 were from areas that were less than 3300 m in altitude (mostly valleys in the Provinces of Anta, Calca, Paucartambo, Quispicanchis and Urubamba in the Department of Cusco), while 13 samples came from areas lying between 3300 and 3500 m that were transitional between the valleys and *puna* formations, and only 6 from *puna* formations lying between 3700 and 4200 m in the

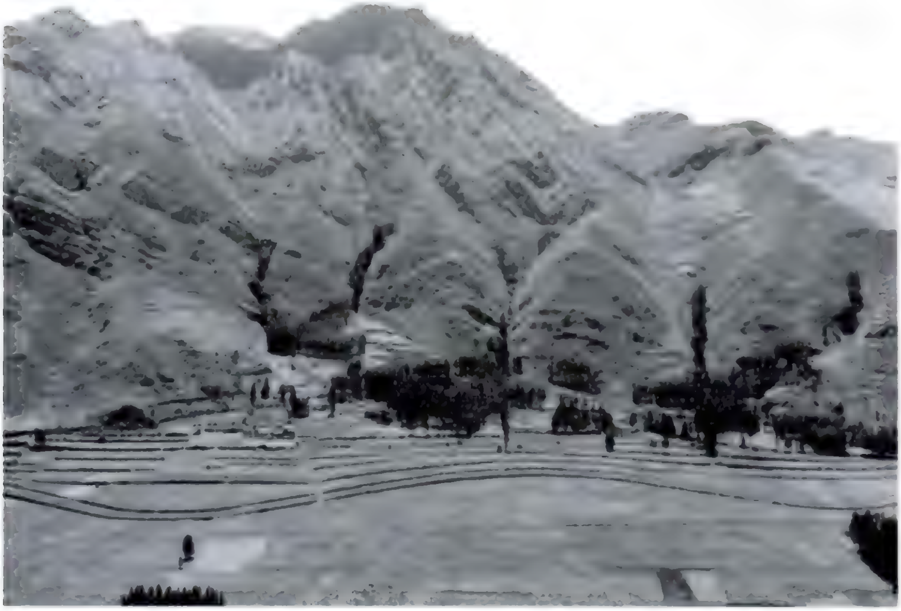


Figure 393. Habitat of *Solanum sparsipilum*, Urubamba Valley, near Pisac, Cusco.

Provinces of Anta and Acomayo (Department of Cusco), Chucuito and Carabaya (Department of Puno) and Andahuaylas (Department of Apurímac).

With respect to its geographic distribution in Peru, this species is presently known only from the Departments of Apurímac, Cusco and Puno (Map 30).

Specimens Examined

Department Apurimac

Province Abancay: Curahuasi, 2800 m alt., among stones, January 1950, *F. Marín 1891* (F).

Province Andahuaylas: Pumapata, 3850 m alt., near Pampachiri, arriving via the road detour Andahuaylas-Pampachiri, May 1975, *C. Ochoa 9801* (OCH).

Department Cusco

Province Acomayo: Acos, 3150 m alt., growing in cultivated land, 1 March 1948, *C. Vargas C. 7082* (CUZ, LL). Cemetery at Pomacanchi, 3735 m alt., near adobe walls, in loose soil, growing with *S. megistacrolobum*, 6 May 1975, *C. Ochoa 7611* (CIP, GH, MOL, OCH, US). Wilcacalle, 4200 m alt., District of Pomacanchi, n.v. *Alkko Papa*, among orccoquisa [=*Urtica*], llaulli [=*Chuquiraga*], chinchircoma [=*Mutisia*] and grasses, February 1982, *R. Ortega 074* (OCH). Near Pillpinto, between Acomayo and Pillpinto, at the margins of corn fields, 15 March 1984, *C. Ochoa 15696* (CIP, OCH).

Figure 394. Near Wilcacalle, Cusco, type locality of "*S. aracc-papa*" (= *Solanum sparsipilum*).

Province Anta: Pampa de Anta, 3400 m alt., along the edge of a field, 18 January 1945, *C. Vargas 4856 C. p.p.* (CUZ, LL and OCH, plants 1, 2 and 3, leaf of *S. raphanifolium* and 4 leaves of *S. sparsipilum*). Chacán, 3500 m alt., along the route Cusco-Urubamba, n.v. *Arakk Papa*, 11 February 1960, *C. Ochoa 2174* (OCH, US). Hillsides of Cerro Puncupata, 3700 m alt., 1 km west of Cachimayo, along the route Cachimayo-Chinchero, April 1971, *C. Ochoa 3052* (OCH, US, plants grown at Universidad Nac. Agraria La Molina, Lima, from the original tubers). Pumatal, 3000 m alt., near km 53 of the Cusco-Machu Pikchu-Quillabamba railroad, on rocky talus slopes, 13 March 1984, *C. Ochoa 15637* (OCH, US).

Province Calca: Urco Farm, 3350 m alt., near Calca. May 11, 1939, *E.K. Balls* and *J.G. Hawkes 6744* (CPC, type of *S. calcense*, from plant grown in field at Edinburgh, Scotland). Pisac, 3200 m alt., wild potato, n.v. *Arakk Papa*, *arvense*, February 1942, *F. Marín 075* (F). Pisac, 3000 m alt., in maize fields, etc., March 1942, *F. Marín 103* (F). Calca, 11 January 1945, *C. Vargas C. s.n.* (CUZ). Hacienda Urco, 2800 m alt., near cultivated fields, 11 January 1945, *C. Vargas C. 4854* (CUZ, LL, OCH 2-sheets, topotype of *S. calcense*). Pisac, 3000 m alt., wild potato, in abandoned sites, humus on rocks, January 1950, *F. Marín 1892* (F). Calca, 3000 m alt., near village. April 24, 1953, *Peterson and Hjerting 1534* (WIS, from living plants grown at Sturgeon Bay, Wis., U.S.A.). Weeds in corn field, hedgerow wet pasture along river, bottom of Rio Urubamba Valley, km 54 on road Cusco-Urubamba, *ca.* 4 km W of Calca (8 km E of Yucay), 2900-3000 m alt., dark purple flower, with small trees, spiny shrubs, many cacti, *Tecoma, Puya, Calceolaria, Croton*, non tuber bearing *Solanum*, 26 December 1962; *H.H. & C.M. Iltis and C. Vargas C. 847* (OCH, US, WIS-3 sheets). Bottom of Rio Urubamba Valley (at km 58), on road to Urubamba, *ca.* 8 km NE from Calca (4 km SE of Yucay. alt. *ca.* 2900 m, 29 December 1962, *H.H. & C.M. Iltis and D. & V. Ugent 903* (US, WIS, 2-sheets); *904* (US, WIS 2-sheets); *904a* (WIS), *904a =PI-310957* (OCH, from plants grown at Sturgeon Bay, WIS, USA) and *905* (OCH, US, WIS-5 sheets and WIS sheet 2A). Bottom of Rio Urubamba Valley at km 56 on road Cusco-Urubamba, ca. 6 km W of Calca (6 km E of Yucay), alt. *ca.* 2900-3000 m, 29 December 1962, *H.H. & C.M. Iltis and D. & V. Ugent 932* (WIS). At km 56 on road Cusco-Urubamba, *ca.* 2900-3000 m alt., bottom of Rio Urubamba Valley, *ca.* 6 km W of Calca (6 km E of Yucay), 29 December 1962, *H.H. & C.M. Iltis and D. & V. Ugent 933 p.p.* (6 sheets, sheet 1a, sheet 1A, sheet 1b, 1c, 2a, 2A, 2b and 2c, all sheets at WIS). Near town of Calca, 2990 m alt., weed in maize field, n.v. *K'itta-papa*, 31 December 1963, *D. Gade s.n.* (WIS). Km 19 on the Cusco-Pisac road (12 km SW of Pisac), growing on top of a stone wall between road and a cornfield. February 17, 1963, *D. &. V. Ugent 3733, 3735, 3736* (WIS) and *3737* (US). 2 km N of Pisac on road to Calca, 2900 m alt., in corn field and on rock-brush-cactus fence, nearby mountain-slope with *Solanum caripense, Mutisia, Oxalis* and non tuberous *Solanum*, February 22, 1963, *D.* &. *V. Ugent 3861* (WIS, sheet-2 and sheet-3); *3862* (US) and 3864 (WIS-6 sheets). Km 54 on the Calca-Urubamba road, just W of Calca, 2975 m alt., road side weed in bean fields, 17 March 1963, *D.* &. *V. Ugent 4452* (US); *4453*, 2 sheets (WIS); *4454*, 2- sheets (WIS) and *4456*, 2 sheets (WIS). Km 53 on the Calca-Urubamba road, 2975 m alt., near Calca, grassy slope along the Urubamba river, 17 March 1963, *D.* &. *V. Ugent 4464*, 2-sheets (WIS). Coya, km 39 between Calca and Pisac, 8 km NW of Pisac by road. Bordering wet drainage ditch between the road and an adobe wall enclosing a cornfield, 17 March 1963, *D.* and *V. Ugent 4466*, 2-sheets (WIS). 23 km from Cusco on road to Pisac, 3300 m alt., in wet quebrada, plants to 1.3 m, leaf 3-jugate, no flowers. April 13, 1971, *J.P. Hjerting, P.J. Cribb* and *Z. Huamán 5147* (CIP). 3 km on road from Pisac to Urubamba, 2850 m alt., in maize field, no flowers, 4 April 1971, *J.P. Hjerting, P.J. Cribb* and *Z. Huamán 5152* (CIP, topotype of *S. calcense*). Taray, 3000 m alt., near Pisac, among maize fields, 16 March 1980, *C. Ochoa 13757*, 2n=24 (CIP, OCH). Near Calca, 3000 m alt., Valle Sagrado, without collection date, *C. Ochoa SC-95*, 2n=24 (=*PI-365343*, WIS, from plant grown at Sturgeon Bay, Wis., U.S.A. in Summer 1987).

Province Canchis: At Evangelical Mission in Sicuani, 3500 m alt., weeds in corn field, 8 January 1963, *H.H.* & *C.M. Iltis* and *D.* & *V. Ugent 1225a* (WIS).

Province Cusco: San Sebastián, [3300 m alt.], ruderal, n.v. *Arakk Papa*, from tubers collected and grown in the field at Leningrad, Russia under No. *1190*, 30 October 1929, Leg. *S. Juzepczuk*, determined by S. Juzepczuk as *Solanum aracc-papa* Juz. (WIR). Cerro Huilcacalle, near Villa San Sebastián [3300 m alt.], not far from the city of Cusco, only tubers collected, 1 August 1927, *S. Juzepczuk* under No. *1455* (WIR, type collection of *S. aracc-papa*, plants grown and propagated near Leningrad, Russia). Grassy shaded bank between San Geronimo and Saylla, flowers bright purple, plants up to 1 m high, 1 March 1958, *D.S. Correll, E.E. Smith and C. Vargas C. P239* (US). 3.5 km NW of Saylla, near small stream, Cusco-Oropeza road, 3159 m alt., weedy, open sunny slope between road and cornfield, near farm house, 7 January 1963, *H.H.* & *C.M. Iltis* and *D.* & *V. Ugent 1203* (US, GH, WIS) and *1203* sheets 1b, 1c, 2a, 2b, 2c, 3a, all at WIS). Vicinity of San Sebastián, 3350 m alt., a frequent weed in corn fields, April 1964, *C. Ochoa* and *J.G. Hawkes 2579* (OCH). Puscar, 3200 m alt., south of San Gerónimo, near Cusco, Valle of the Vilcanota, in maize fields, n.v. *Arakk Papa*, 10 April 1971, *C. Ochoa 2989* (OCH, US). Sempicona, 3280 m alt., between Saylla and Oropeza, south of Cusco, Valley of the Vilcanota, among old stone and adobe enclosures, in the shade of trees of *Schinus molle*, 10

April 1971, *C. Ochoa 2990* (CIP, OCH). Hueraccochan, 3250 m alt., between San Gerónimo and Saylla, Valle of the Vilcanota, south of Cusco, n.v. *Atokk Papa*, abundant in cultivated fields of potato and maíze or among old stone walls, 6 March 1980, *C. Ochoa 13697*, 2n=24 (CIP, GH, OCH, USM, US). Huilcarpay, 3400 m alt., 3 km west of San Sebastián, near Cusco, in hedgerows of *Agave* sp., on the lower slopes of a mountain, rare, 10 March 1980, *C. Ochoa 13708, 2n=24* (CIP, GH, OCH, USM, US, topotype of *S. Arakk-papa*). Granja K'ayra, 3220 m alt., on the lower part about 500 m to the right of the principal entrance, flowers purple, berries round or pyriform, 29 March 1981, *C. Ochoa 14377* (OCH, USM, US).

Province Paucartambo: Challabamba, 2900 m alt., 15 km north of Paucartambo, following along the Paucartambo-Challabamba road, n.v. *Machu Papa*, in thickets of herbs and shrubs, 22 February 1960, *C. Ochoa 2212*, 2n=24 (OCH). 9.5 km from Huambutio, on road to Pisac, along the Urubamba river, 3000 m alt., (13° S, 71° W), growing under *Schinus molle* along a rock, *Ephedra*, columnar cactus fence bordering a cornfield, with *Oxalis*, *Ipomoea* sp., *Cassia*, 18 March 1963, *D. & V. Ugent 4472*, sheet-2 (OCH); *4473*, 4 sheets (WIS); *4474*, 3 sheets (WIS); *4475*, 2 sheets (WIS); *4476* (WIS); *4478* (WIS); *4479* (US, WIS 2 sheets); *4480*, 2 sheets and *4481* (WIS). Between Paucartambo and Pajlaira, 3000 m alt., along the route Paucartambo-Pumachaca, near Paucartambo, within lush herbaceous vegetation, 22 February 1980, *C. Ochoa 13642*, 2n=24 (CIP, OCH). Pajlaira, 3000 m alt., near Paucartambo, between Paucartambo and Pumachaca, in a maize field, tubers small, 2-3 cm in dia., white, 22 February 1980, *C. Ochoa 13644*, 2n=24 (OCH, from plants grown in the greenhouse at Huancayo). Ccaratuyocc, *ca*. 3350 m alt., heading up to Acjanacu by the Paucartambo-Pilcopata highway, much before Pillahuata and before the detour to Tres Cruces, on steep talus slopes in very moist black soil, 24 February 1980, *C. Ochoa 13647* (CIP, MOL, OCH, US). Along the Paucartambo-Huacaca horse trail, 3380-3500 m alt., 10 km east of Paucartambo, in loose, black and very moist soil, flowers purple, large, 22 February 1980, *C. Ochoa 13655*, 2n=24 (CIP, F, GH, MOL, OCH, UNTC, USM, US) and *13656*, 2n=24 (CIP, F, GH, MOL, OCH, US). Heading down by horseback from Ccachupata to Huacaca, along the route to Paucartambo, 3270 m alt., flowers purple, large, 25 February 1980, *C. Ochoa 13657*, 2n=24 (CIP, F, GH, MOL, OCH, UNTC, USM, US).

Province Quispicanchis: Collected at Hacienda Lucre, near Cusco, 1932, *M. Kaufman s.n.* (WIR K-20, type collection of *S. catarthrum*, plant propagated near Leningrad in 1933). Vicinity of Lucre, 3200 m alt., south of Cusco, 6 March 1962, *C. Ochoa 2401*, 2n=24 (MOL, OCH). Km 63 on road from Cusco to Sicuani, between Urcos and Quiquijana, 3189 m alt., at village Acopata, 5 km SSE of Tt'io, in field with corn and many potatoes intermixed, 7 January 1963, *H.H. Iltis* and *D. Ugent 1214* (GH, OCH 2 sheets, US, WIS 5 sheets). Vicinity of

Lucre, 3250 m alt., in maize field, 10 February 1963, *C. Ochoa 2444*, 2n=24 (F, GH, MOL, OCH, US, topotypes of *S. catarthrum*). Rajchi, 3095 m alt., near Oropesa, rocky slope below small native house with *Nicotiana, Piper, Chenopodium, Oxalis, Salvia, cactus* and non-tuberous *Solanum* sp., 28 February 1963, *D. & V. Ugent 3982* sheets 1, 2 (WIS); *3983* sheets 2, 3, 4, 5, 6, 7 (WIS); *3984* sheets 1, 2, 3, 4 (WIS); *3985* sheets 2, 3, 4 (WIS); *3986* sheets 1, 2 (WIS); *3987* sheets 1, 2 (WIS) and *3988* (US). District of Lucre, Hacienda Lucre, 3150 m alt., cultivated fields of maize in grassy paths, 18 April 1964, *J.G. Hawkes 2477* (OCH, WI, USA, from plants grown at IR-1 Project, Sturgeon Bay, Wis., USA under No. *PI-311000*). Between Paucarpata and Chuquicahuana, 3250 m alt., in cultivated fields of barley, 16 February 1980, *C. Ochoa 13626-A*, 2n=24 (OCH, USM from plants grown in the greenhouse at Huancayo). Between Accopata and Muyurina, near Quiquijana, 3200 m alt., within old stone and adobe enclosures protected by *Opuntia exaltata,* near maize fields, flowers deep purple, corolla pentagonal, 12 March 1980, *C. Ochoa 13718* (CIP, F, GH, MOL, OCH, UNTC, USM, US). Near Chuquicahuana, 3370 m alt., along the Cusco-Sicuani highway route, with *Scycios, Poa, Opuntia exaltata, Tropaeolum cristagalli* and trees of *Buddleja* sp., n.v. *Atokk Papa*, 12 March 1980, *C. Ochoa 13727*, 2n=24 (CIP, MOL, OCH, US).

Province Urubamba: In maize fields, 2800 m alt., 11 February 1946, *C. Vargas 7071* (CUZ, LL). Pumahuanca, 2900 m alt. [near Urubamba], on rocky hillsides, scarce, fruit subglobose, 18 January 1949, *C. Vargas C. 7595* (CUZ, LL, OCH, type collection of *S. membranaceum*). Phiri, 2800 m alt., December 1950, *C. Vargas C. 9824* (CUZ, LL, MO, type collection of *S. calcense* var. *urubambae*). On rocky bank, 4 km west of Urubamba, 2900 m alt., plant robust up to 5 ft. tall, much branched (specimens are branches), flowers bluish lavender, rotate, 27 February 1958, *D.S. Correll, E.E. Smith and C. Vargas C. P231* (LL, US), also under *PI-246536* from plant grown in field at Sturgeon Bay, Wis., USA (OCH). Along the embankment of the Cusco-Machu Pikchu railroad line, near Ollantaytambo, 3 March 1958, *D.S. Correll and E.E. Smith P260* (LL). Pisac, 2800 m alt., on rocky hillsides near bridge, heading down the Cusco-Pisac highway via Huilcacalle, 16 February 1960, *C. Ochoa 2190*, 2n=24 (OCH). Ahuaimarca, 2840 m alt., near Urubamba, heading up to the Quebrada de Pumahuanca, in lush herbaceous vegetation, 18 February 1960, *C. Ochoa 2193* (OCH). Keru-cancha, 2820 m alt., near Urubamba, within stone enclosures, 18 February 1960, *C. Ochoa 2194*, 2n=24 (OCH, US) and *2195* (OCH). Ollanta, 2600 m alt., near railroad station, flowers violet, small, 15 February 1963, *C. Ochoa 2443* (OCH). At km 61 road from Urubamba to Calca (Hacienda Killes-Huayoccari) *ca*. 2 km NW of Calca, *ca*. 3000 m alt., with weeds in fertile deep-soil cabbage fields (*Brassica* associated with *S. calcense, Rumex, Eragrostis, Oxalis,* *Polygonum, Galinsoga,* etc., 29 December 1962, *H.H. Iltis, D. & V. Ugent 871* (US 2 sheets, WIS 7 sheets) and *872* (GH, OCH 3 sheets, WIS 2 sheets). Lower end of Quebrada Pumahuanca, a deep side Valley of Rio Urubamba, *ca.* 2-4 km NW of Urubamba (72° 3' W, 13° 12' S); 3200-3600 m alt., among *Berberis, Eupatorium, Cereus, Puya, Baccharis, S. raphanifolium,* on paths and under shrubs, 31 December 1962, *H.H. Iltis, D. & V. Ugent 982 p.p.* (US 2 sheets, WIS 4 sheets); *982-1,* 2 sheets; *982-2, 982-3,* 2 sheets (WIS). Pachar, *ca.* 2800 m alt., vicinity of railroad and hedgerows and fields, 1 km to the east, in broad valley of Rio Urubamba, 4 km below Urubamba, 4 January 1963, *H.H. Iltis, D. Ugent 1143 p.p.,* plant 2 (US). Urubamba, growing in corn field, 31 December 1962, *D. Ugent s.n. = PI-310959* (OCH, from plant grown at Sturgeon Bay, Wis, USA). Urubamba, ca. 2800 m alt., across from C. Vargas C. house, weed in field of *Zea mays,* 5 January 1963, *H.H. Iltis* and *D. Ugent: 1152* (US, WIS); *1153* (WIS) and *1153* sheet 2, 4 sheets (WIS). Half km E of Urubamba, on road to Calca, *ca.* 2800 m alt., in cornfield shaded by Eucalyptus, flowers small to large, 5 January 1963, *H.H. Iltis* and *D. Ugent 1156* (GH, US, WIS 6 sheets). Quebrada de Pumahuanca, 2850 m alt., near Urubamba, in maize field, flowers white or very pale lilac, n.v. *Yuracc Arakk Papa,* 18 March 1972, *C. Ochoa 3616,* 2n=24 (OCH, plants grown at La Molina, Lima, from the original tubers). Urubamba, 2800 m alt., in a maize field at the country house of C. Vargas C., n.v. *Atokk Papa,* 22 May 1975, *C. Ochoa 8358,* 2n=24 (CIP, GH, MOL, OCH, USM, US). Yucay, Granja Salesiana, 2700 m alt., April 1978, *C. Ochoa 12503* (OCH), *12504* (OCH) and *12505* (OCH). Between km 86 of the Cusco-Machu Pikchu-Punchay-unuyocc railroad line, 2675 m alt., before Ccorihuayrachina, on rocky talus slopes or near paving stones of the railway line, flowers purple, 5 February 1980, *C. Ochoa 13588,* 2n=24 (CIP, GH, OCH, UNTC, USM, US). Hacienda San Antonio, on the lower slopes of Cerro Apu Ccori, 2600 m alt., near Torontoy and before Ccorihuayrachina, in the canyon of the Río Urubamba, along the route of the Cusco-Machu Pikchu railraod line, weed, at the margins of maize fields, n.v. *Ckita Papa* (=Papa silvestre) or *Arakk Papa,* 5 January 1980, *C. Ochoa 13589* (CIP, F, GH, MOL, OCH, US). Unoraquina, 2900 m alt., west of Yucay, Valle Sagrado, along the pedestrian trail to San Juan, before El Molino, 18 March 1980, *C. Ochoa 13774* (CIP, F, GH, MOL, OCH, US). Aguas Calientes, *ca.* 2500 m alt., fruits round to ovoid, light green with sparsely distributed white dots, 15 March 1980, *C. Ochoa 13786,* 2n=24 (CIP, OCH, US). Near km 107-108 of the central station of the Cusco-Quillabamba railroad line, 2100 m alt., material rare and poor, without flowers, 22 March 1981, *C. Ochoa 14357* (OCH). Puente Consevidayokk, District of Ollantaytambo, 2700 m alt., flowers deep violet, 16 April 1992, *C. Ochoa and A. Salas 16146* (CIP, OCH). Puente Consevidayokk, District of Ollantaytambo, 2700 m alt., 16 April 1992, *C. Ochoa and A. Salas*

16147 (OCH). Near Puente Consevidayokk, 2880 m alt., herb 30-40 cm tall, flowers white, 16 April 1992, *C. Ochoa and A. Salas 16148* (CIP, MOL, CH). Puente Consevidayokk, District of Ollantaytambo, 2700 m alt., flowers blue-violet, 16 April 1992, *C. Ochoa and A. Salas 16149* (OCH). Chullarakkay, District Ollantaytambo, 2880 m alt., on rocky hillsides, flowers white, berries ovoid, 8 February 1995, *C. Ochoa and A. Salas 16198* (OCH). Chullarakkay, District Ollantaytambo, 2880 m alt., on rocky hillsides, flowers light blue-violet, 8 February 1995, *C. Ochoa and A. Salas 16199* (OCH). Quebrada de Pumahuanca, 2900 m alt., in fields of maize, weed, *C. Ochoa s.n.* (CIP, NY, OCH, US, topotypes of *S. membranaceum*).

Department Puno

Province Carabaya: Pacuchama, 4200 m alt., above Juro Juro, *puna* in the community of Pacaje, on grassy hillsides, near the Macusani-Ollachea highway, n.v. of the plant *K'ita Papa*, of the berries *Mamarco* or *Ckucari*, 31 March 1974, *C. Ochoa 5123*, 2n=24 (CIP, GH, OCH, US).

Province Puno: Chucuito, 31 km from Desaguadero on road to Puno, 3900-4000 m alt., flower blue violet, 5 April 1971, *J.G. Hawkes, J.P. Hjerting, P.J. Cribb and Z. Huamán 5057 p.p.*, (plant 1 CIP and OCH from plant grown at Huancayo from seeds of *PI-458378).*

Putative Natural Hybrids of *Solanum sparsipilum* (Bitt.) Juz. et Buk.

Although only few hybrids of *S. sparsipilum* were encountered among the many herbarium collections of this species that were examined by the author, it is quite possible that a certain amount of gene flow occurs in nature between *S. sparsipilum* and other wild potato species, particularly in the Valleys of the Vilcanota, Urubamba and Paucartambo, where this species sometimes grows in close proximity to such cross-compatible species as *S. raphanifolium*, *S. coelestispetalum*, *S. marinasense* or *S. bukasovii*.

Solanum sparsipilum × *S. raphanifolium*

All specimens are diploid (2n=24) and trend towards *S. raphanifolium* in morpohology, and are especially similar to that species in regard to the shape of their leaves.

Department Cusco

Province Quispicanchis: Vicinity of Lucre, 3200 m alt., south of Cusco, 6 March 1962, *C. Ochoa 2402*, 2n=24 (CIP, OCH). Vicinity of Lucre, 3250 m alt., in maize fields, 10 February 1963, *C. Ochoa 2445*, 2n=24 (CIP, OCH). Quebrada de Pampacolca, 3250 m alt., entering by the Chuquicahuana bridge, along the route Cusco-Chuquicahuana-Quiquijana, plants 30 cm tall, flowers light violet, with *Oxalis, Poa, Rumex,* protected by columnar cacti such as *Trichocereus* and *Opuntia exaltata*, along old enclosures nearly covered by *Tropaeolum cristagalli*, 12 March 1980, *C. Ochoa 13719*, 2n=24 (OCH).

Solanum sparsipilum × *Solanum sp.*

Plants lax or semi-decumbent, 40-50 cm tall, sparsely pilose; Leaves poorly divided; Inflorescence paniculate; Anther column well-formed, vigorous, but sterile or with little pollen; Corolla rudimentary, nearly obsolete (perhaps due to an auxin imbalance), with violet petals scarcely distinguishable at the base of the anthers.

Represented by a single triploid (2n=36) collection. The odd appearance and ploidy level of this hybrid makes it difficult to explain its origin. It is possible that it is an autotriploid derived from crosses between two diploid individuals of the same species, *S. sparsipilum-2x*, with one parent contributing an unreduced gamete, and the other a gamete which is normally reduced. The other possibility is that this is a cross between *S. sparsipilum* and some other diploid wild potato species, or perhaps even a cross between *S. sparsipilum* and the cultivated tetraploid *S. tuberosum* subsp. *andigena*.

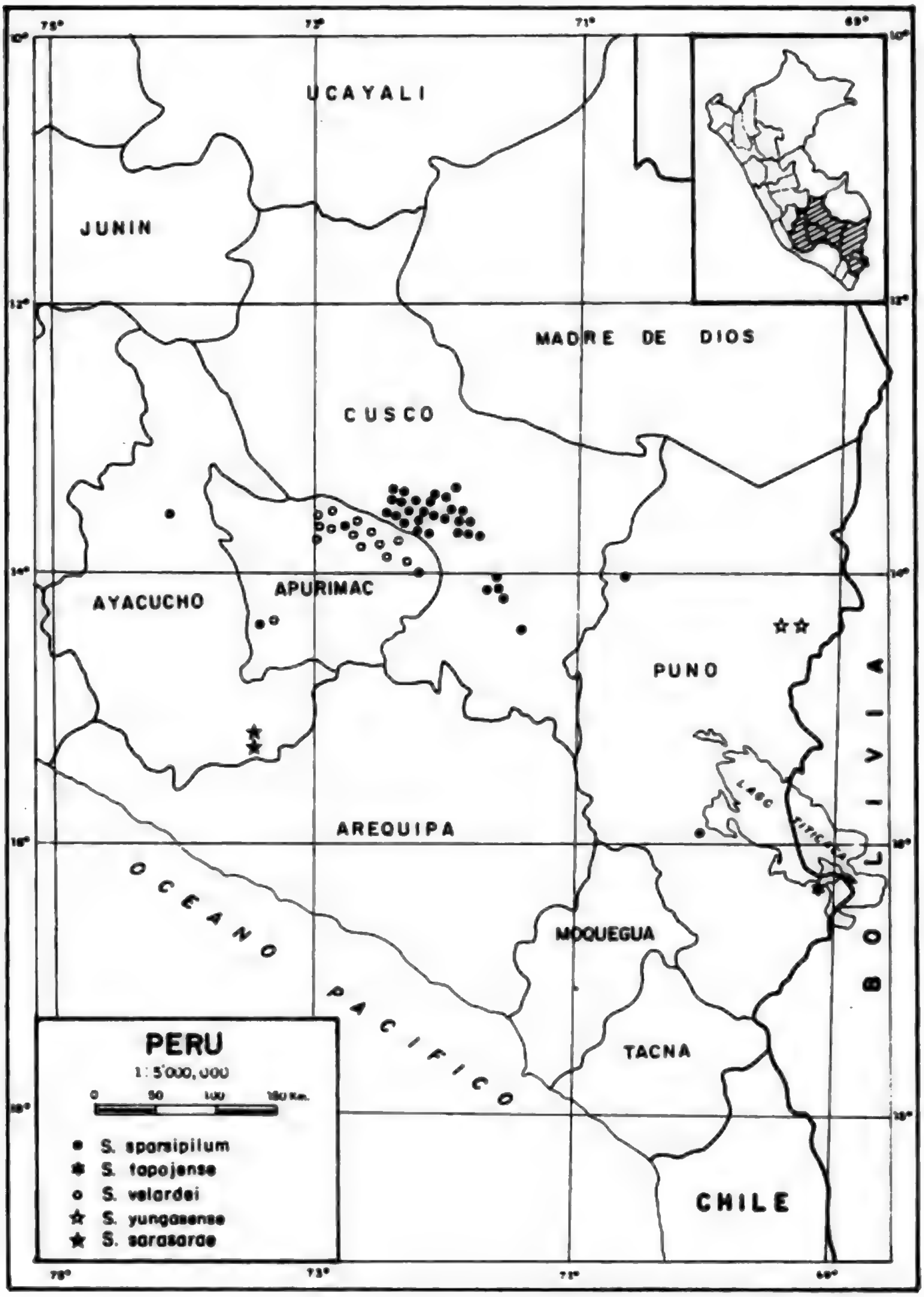
Department Cusco

Province Urubamba: Vicinity of Ahuaymarca, 2840 m alt., near Urubamba, heading up from Urubamba to the Quebrada de Pumahuanca, growing on top of stone and adobe enclosures, these covered by *Tropaeolum cristagalli* and protected by *Opuntia exaltata*, 18 February 1960, *C. Ochoa 2192*, 2n=36 (OCH, US).

Breeding Potential

The results of crosses of *S. sparsipilum* with diploid species (2n=24) of EBN=1 and EBN=2, triploids (2n=36), tetraploids (2n=48) of EBN=2 and EBN=4 and hexaploids of EBN=4 are given in Table 98, while the materials used in these experiments are shown in Table 99.

Solanum sparsipilum is highly cross-compatible with *S. alandiae*, *S. raphanifolium*, *S. phureja*, *S. goniocalyx* and *S. tapojense*. Average seed yields in crosses with these species range from 100 to more than 270 a berry. A fair



Map 30. Distribution of *S. sparsipilum*, *S. tapojense*, *S. velardei* and *S. yungasense*.

amount of compatibility (ranging from 125 to 164 seeds per berry) was also obtained in crosses of *S. sparsipilum* with *S. berthaultii* and *S. marinasense* when this species was used as the pistillate parent; whereas crosses with *S. candolleanum*, *S. coelestispetalum*, *S. bukasovii* and *S. orophilum* resulted in an average of 105 to 283 seeds per berry when *S. sparsipilum* was used as the staminate parent. Although the above species, with the exception of *S. raphanifolium* of the Series Megistacroloba, are all members of Series Tuberosa and have an EBN value of 2, two other members of Series Tuberosa, *S. huancabambense* and *S. multiinterruptum*, were not compatible with *S. sparsipilum* even though they were of the same EBN value. Other failures include the reciprocal crosses made with *S. cantense* of the Series Piurana, and the unilateral crosses made with *S. gandarillasii* of the Series Tuberosa and those made with *S. limbaniense* of the Series Conicibaccata.

It is also of some interest to note that the reciprocal crosses of *S. sparsipilum* with such distantly related species as *S. infundibuliforme* (Series Cuneoalata), *S. megistacrolobum* (Series Megistacroloba) and *S. chomatophilum* (Series Conicibaccata) resulted in the production of some seed, although the yields in each case were relatively low. Other results include a fairly high average number of seeds (162-190) obtained in crosses with two very different appearing species, *S. brevicaule* of Series Tuberosa and *S. santolallae* of Series Conicibaccata, and a much lower average number of seeds per berry (20-40) with *S. stenotomum* (Series Tuberosa), *S. urubambae* (Series Conicibaccata) and *S. litusinum* (Series Yungasensa).

Particularly interesting is the fact that reciprocal crosses of *S. sparsipilum* with plants as distantly related in morphology and ploidy level as *S. sparsipilum-2x* and *S. yungasense-3x* resulted in the production of fertile berries, these containing from 33 to 56 seeds per fruit on the average. No less interesting is the fact that unilateral crosses of this species with *S. acaule-4x*, *S. tuberosum* subsp. *andigena-4x* and *S. oplocense-6x* resulted in 50, 167, and 50 seeds per berry, on the average. All the unilateral crosses made with *S. albicans-6x*, on the other hand, were unsuccessful (see Table 98).

Lastly, the experimental trials conducted by Rabinowitz *et al.* (1988, 1989) in the Andes of Peru near Cusco are of some interest here. Berries were obtained from a number of different clones of *S. sparsipilum* and *S. stenotomum* that were planted in randomized plots. These were found subsequently to contain mostly hybrid seed, this resulting, probably, largely from the open pollination conditions that existed in the field. From the evolutionary standpoint, such gene flow may be important under natural conditions, as it may explain the origins of certain local Andean races that appear to blend the characteristics of the wild species with those of the cultivated diploids.

Table 98. Fertility of *Solanum sparsipilum* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	LIGNICAULIA	× *S. lignicaule*	6	3	0
24	2	CONICIBACCATA	× *S. chomatophilum*	14(10)	10(3)	6(12)
			× *S. laxissimum*	4	4	162
			× *S. limbaniense*	5	1	0
			× *S. urubambae*	26	3	33
24	2	CUNEOALATA	× *S. infundibuliforme*	25(4)	5(4)	23(13)
24	2	MEGISTACROLOBA	× *S. megistacrolobum* var. *toralapanum*	2(4)	2(3)	10(67)
			× *S. raphanifolium*	47(72)	30(52)	119(151)
24	2	PIURANA	× *S. cantense*	8(5)	0(5)	0(0)
24	2	TUBEROSA	× *S. alandiae*	27(11)	24(7)	165(134)
			× *S. brevicaule*	8	4	190
			× *S. bukasovii*	133(210)	89(37)	78(82)
			× *S. bukasovii* f. *multidissectum*	10(14)	6(8)	51(155)
			× *S. candolleanum*	46(76)	44(61)	74(139)
			× *S. coelestispetalum*	47(18)	37(10)	76(110)
			× *S. gandarillasii*	17	11	0
			× *S. goniocalyx*	60(46)	33(29)	114(106)
			× *S. huancabambense*	7(6)	0(0)	0(0)
			× *S. leptophyes*	2(23)	2(8)	135(27)
			× *S. marinasense*	24(17)	23(8)	125(108)
			× *S. multiinterruptum*	10(14)	0(2)	0(0)
			× *S. orophilum*	50(43)	26(29)	37(283)
			× *S. phureja*	15(9)	15(7)	139(223)
			× *S. stenotomum*	4	3)	40
24	2	YUNGASENSA	× *S. berthaultii*	12(7)	11(1)	164(15)
			× *S. litusinum*	9	2	20
			× *S. tarijense*	31(30)	13(13)	38(23)
24	2	TUBEROSA	× *S. tapojense*	31(45)	24(28)	223(177)
36	-	YUNGASENSA	× *S. yungasense*	4(9)	3(9)	33(56)
48	2	ACAULIA	× *S. acaule*	3	1	50
48	4	TUBEROSA	× *S. tuberosum* subsp. *andigena*	5	3	167
72	4	ACAULIA	× *S. albicans*	9	0	0
72	4	TUBEROSA	× *S. oplocense*	1	1	50

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 99. Collections (OCH) used in *Solanum sparsipilum* fertility studies.

ACAULIA
S. acaule 13149
S. albicans 11842

CONICIBACCATA
S. chomatophilum 11061, 13205
S. laxissimum 14358
S. limbaniense 14291
S. urubambae 13779

CUNEOALATA
S. infundibuliforme 11941, 11977

LIGNICAULIA
S. lignicaule 11617, 14416

MEGISTACROLOBA
S. megistacrolobum var. *toralapanum* 11964, 12098
S. raphanifolium 7610, 8333, 13569, 13575, 13577, 13625, 13654, 13735, 14346

PIURANA
S. cantense 14681

TUBEROSA
S. alandiae 12014, 12017, 12018
S. brevicaule 11934
S. bukasovii 7715, 7726, 8693, 11058, 11295, 11301, 11306, 11337, 11841, 11844, 11859, 11870, 11871, 11872, 11873, 11874, 11876, 13168, 13542, 13543, 13558, 13559, 13598, 13599, 13600, 13680, 13694, 13713, 13715, 13729, 13731, 13854, 14333, 14407, 15304
S. bukasovii f. *multidissectum* 11843, 11868, 13720
S. candolleanum 11814, 11835, 11897, 11913
S. coelestispetalum 7710, 7728, 13605, 13690, 13802, 14350
S. gandarillasii 12010
S. goniocalyx 00001, 14502, 562-85, 762-85
S. huancabambense 11627
S. leptophyes 13733
S. marinasense 13673, 13675, 13737, 13738, 13740, 13749A
S. multiinterruptum 11879
S. oplocense 11972
S. orophilum 12077, 12078, 12080, 12082, 13003
S. phureja 15074, 15133, 15137
S. sparsipilum 7611, 8358, 11820, 11822, 11893, 11894, 11911, 11939, 12028, 12030, 12035, 13564, 13588, 13644, 13657, 13697, 13708, 13718, 13719, 13757, 13774, 13786, 15522, 15637, 15699
S. stenotomum 435-85
S. tapojense 11821
S. tuberosum subsp. *andigena* 11827

YUNGASENSA
S. berthaultii 12029
S. litusinum 12027
S. tarijense 11994, 12001
S. yungasense-3x 15029

83. ***Solanum tacnaense*** Ochoa, Agronomía, Lima, 18(74):133, 135-136, illustr., 1953. (Reprinted pp. 19, 21-22, illustr., 1953).

Figs. 395-399; Map 29.

Plant bushy, weakly erect or subdecumbent, small, (25-)40-50 cm tall, coarsely and densely pilose; stem robust, (3-)6-8 mm in dia. at base, slightly pigmented, simple or branched, flexible, sparsely pilose, narrowly and inconspicuously straight winged; internodes (1-)2-4(-6) cm long. Stolons to 50 cm or more long, thick and fleshy, 2-3 mm in dia.; tubers round to ovoid, slightly compressed, whitish-yellow, 4-5 cm long. Leaves imparipinnate, (8.0-)9.5-19.0(-21.0) cm long by (5.5-)6.0-10.5(-12.0) cm wide, with 2-3(-4) pairs of lateral leaflets and 0-1(-2) pairs of interjected leaflets; leaflets light green, coarsely and sparsely pilose above, pale green and somewhat more densely and finely pilose on the veins and veinlets below, rachis pilose. Leaflets elliptic-lanceolate or elliptic-oblanceolate to ovate-rhombic, with subobtuse or pointed tips (occasionally abruptly and shortly acuminate) and cuneate or symmetrical to obliquely rounded bases, shortly petiolulate, margins crenulate or subcrenulate, pilose and finely denticulate. Terminal leaflet slightly larger than the adjacent laterals, (3.5-)4.5-7.0(-8.5) cm long by (2.0-)2.7-3.0(-3.5) cm wide; the first pair of lateral leaflets (3.0-)3.5-6.0(-7.5) cm long by (1.0-)1.5-2.7(-3.0) cm wide, conspicuously decurrent about the rachis. Pseudostipular leaves narrow and asymmetrically elliptic-lanceolate or lunate, 7-15 mm long. Inflorescence terminal or subterminal, erect, cymose-paniculate, 10-25-flowered; peduncle vigorous, (8-)12-15 cm long and 2.0-2.5 mm in dia. at base, pigmented and pilose as in the case of the pedicels and calyx, hairs long and white, sparsely distributed; pedicels slender, 25-35 mm long, somewhat glandular, articulated 4-6 mm below the base of the calyx. Calyx symmetrical, (7-)10-12 mm long, densely pilose, lobes reflexed, ovate to ovate-lanceolate, the margins broadly scarious at base, apex long-acuminate, acumens linear-lanceolate to subspatulate, 3-5 mm long. Corolla rotate, deep blue or blue-violet, 3-4 cm in dia., internal star purple or dark gray, nearly black, shining. Anthers lanceolate, 5.5-6.0 mm long, yellowish-orange, typically bi- or trilobed at base on the dorsal side, without a well defined dorsal groove; filaments less than 1 mm long, broad, glabrous. Style 10-11 mm long, slender, exerted 4-5 mm, densely papillose along the lower two-thirds of its length; stigma typically claviform, cleft with a very pointed angular sinus, nearly closed. Fruit globose, 1.0-1.5 cm in dia., dark green, with irregular spots of deep violet. Chromosome Number: 2n=24. EBN=2.

Type: PERU. Department and Province of Tacna, Toquepala, 3140 m alt., on rocky-sandy talus slopes of the Camiara-Toquepala road, 23 March 1953, *C. Ochoa 2046* (holotype OCH, isotypes GH, US) and *C. Ochoa 2047* (paratype OCH).

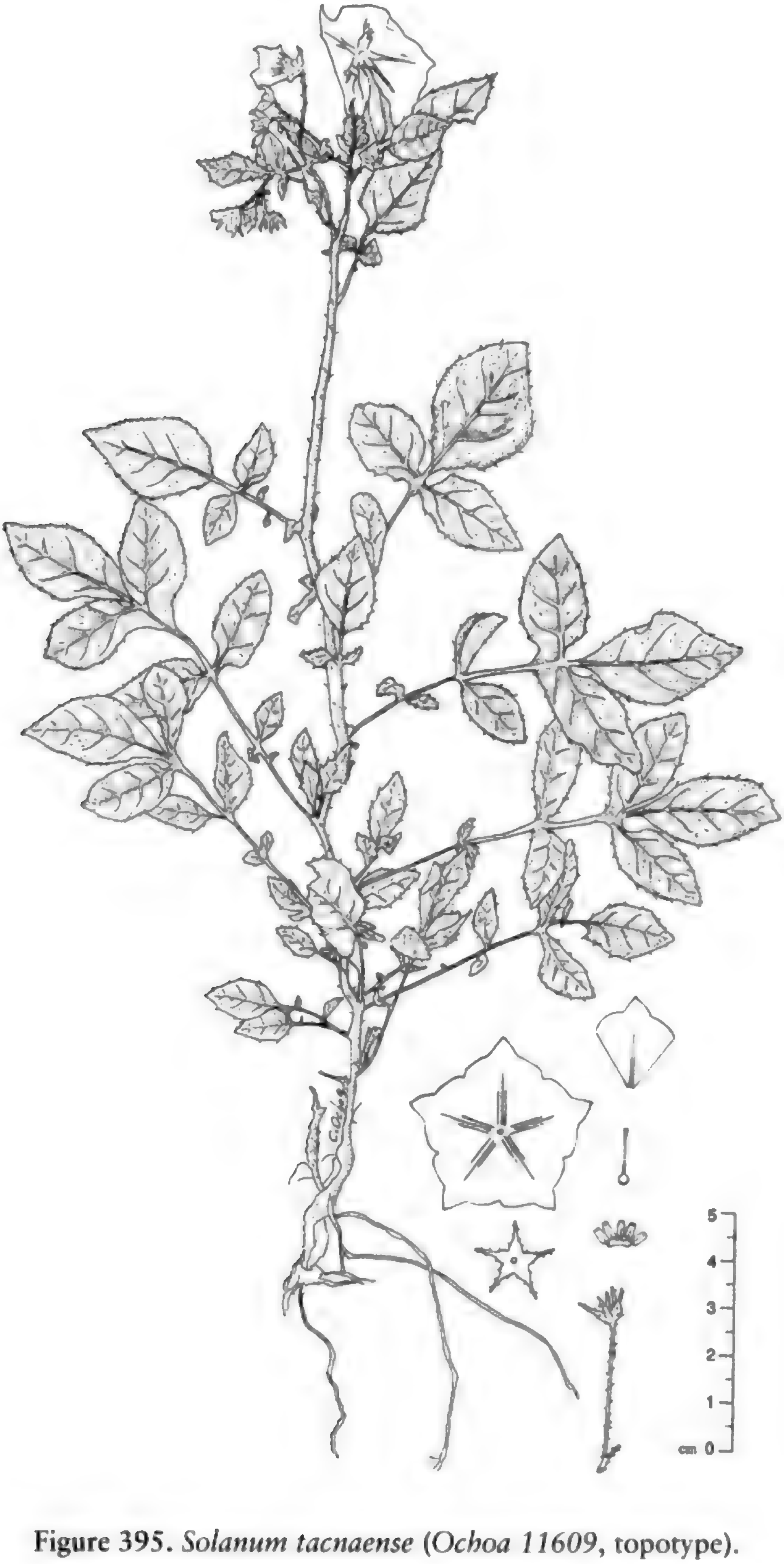


Figure 395. *Solanum tacnaense* (*Ochoa 11609*, topotype).

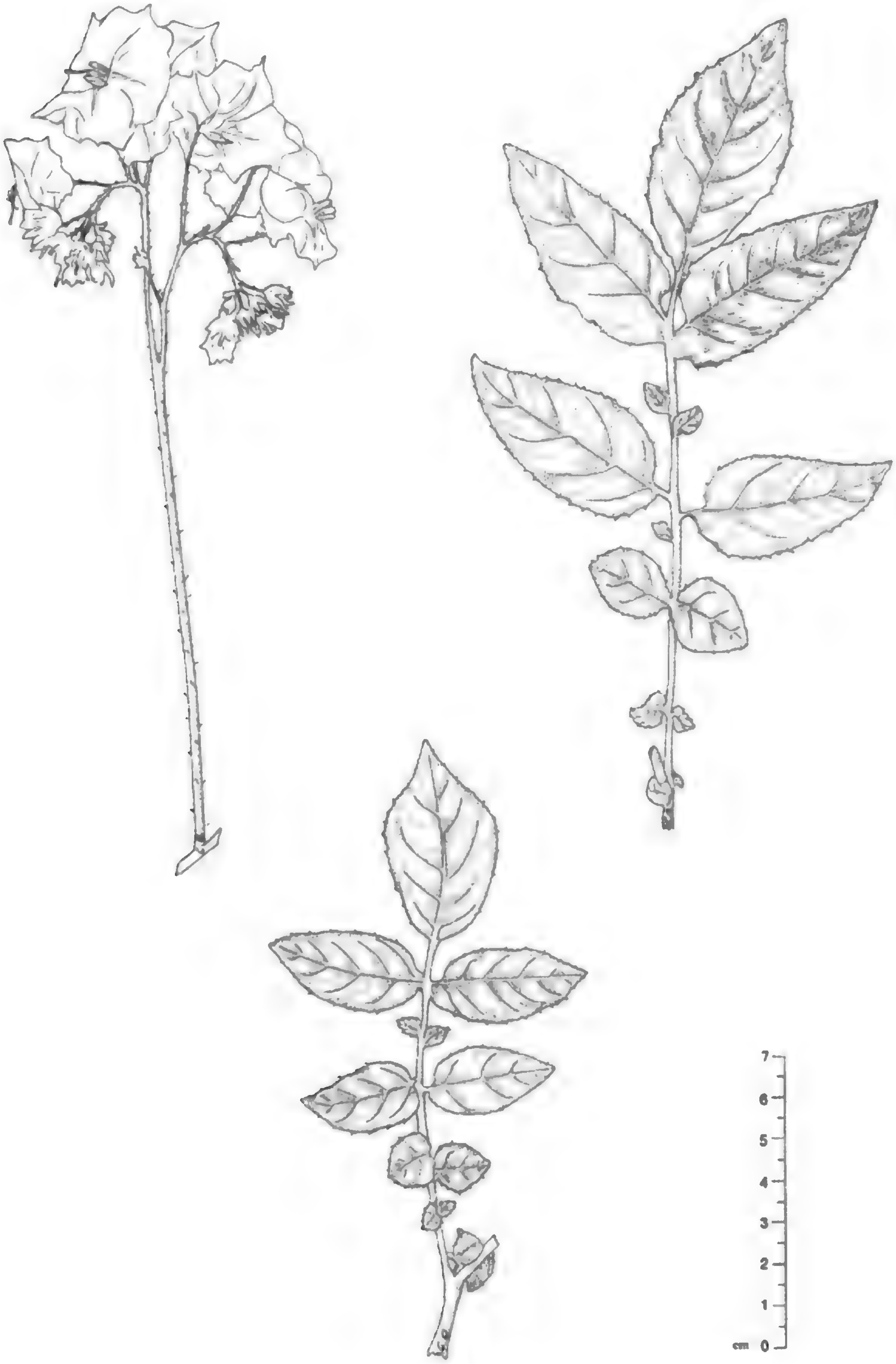


Figure 396. Inflorescence and leaves of *Solanum tacnaense* (*Ochoa 2046*, isotype).

Affinities

Solanum tacnaense is related to the typical form of *S. medians*. The two have corollas of similar shape and size and both have the calyx lobes strongly reflexed. Also, the vegetative parts of both species are densely covered with coarse hairs. However, in other respects the two species are quite different from one another. The rosette-like habit of *S. tacnaense*, for example, is much more pronounced than in *S. medians* and the floral peduncles of this species also tend to be much longer. Moreover, the leaflets of this species are narrower and more pointed than those of *S. medians*, and their margins tend to be more conspicuously denticulate.

Habitat and Distribution

This species grows preferentially in dry, sandy or rocky soils on cool mountain slopes. It is commonly associated with spiny shrubs of the genus *Dunalia* sp. or columnar cacti of the genus *Oreocereus* sp.

Solanum tacnasense is distributed from the Departments of Moquegua and Tacna in southern Peru (Map 29) to the Province of Tarapacá in northern Chile.

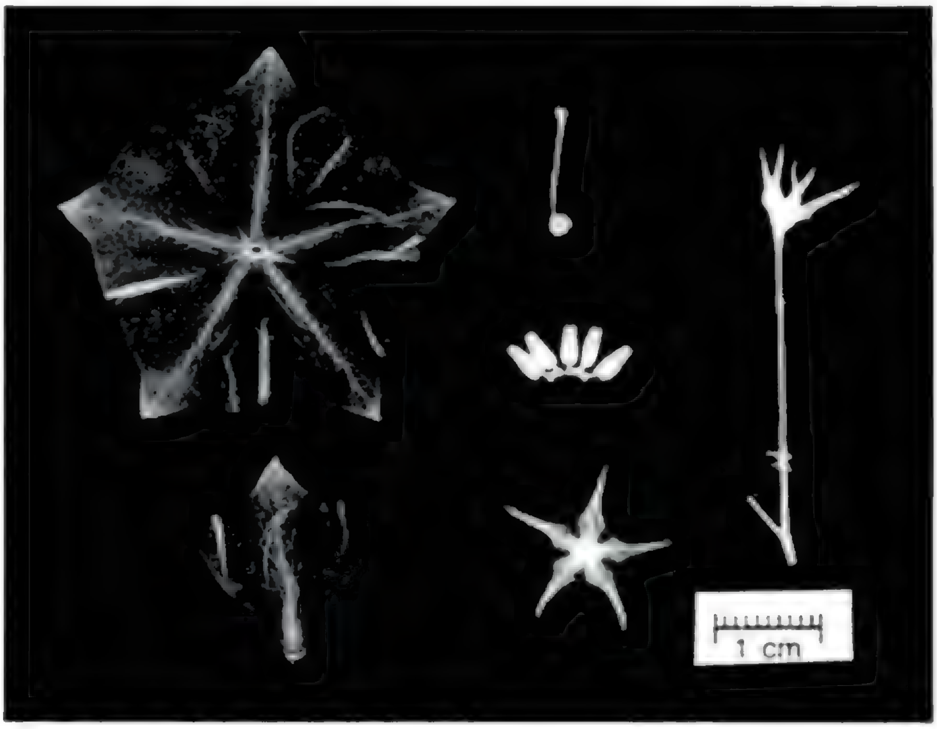


Figure 397. Floral dissection of *Solanum tacnaense* (*Ochoa 11609*).

Specimens Examined

Department Moquegua

Province Mariscal Nieto: Carumas, 2600 m, open mixt. Formation, decumbent, tuberous, flowers violet, 21 February-6 March 1925, *A. Weberbauer 7276* (F). Above the Hospital of the Cuajone Mine Complex, 3100 m alt., about 15 km (in a straight line) north-northeast of Torata, plants very young, 2 April 1977, *C. Ochoa 11611* (OCH, original collection; CIP, OCH, plants grown in an open field at Huancayo; CIP, GH, OCH, from greenhouse plants at Huancayo; CIP, OCH, from plants grown in the greenhouse at La Molina, Lima) and *11612* (OCH, plant grown in the greenhouse at Huancayo; CIP, GH, OCH, US, plants grown in the experimental field at Huancayo).

Department Tacna

Province Tacna: Near the Toquepala Mines, 3140 m alt., a few km before the mine radio station, on rocky-sandy talus slopes of the Camiara-Toquepala road, 22 March 1953, *C. Ochoa 2046* (GH, OCH, US, type collection of *S. tacnaense*), and *C. Ochoa 2047* (paratype OCH). Above the slag pile of the Toquepala Mine, District Ilabaya, 3100 m alt., 2 April 1977, *C. Ochoa 11609* (topotypes CIP, OCH; CIP, GH, MOL, OCH, plants grown in the greenhouse at La Molina, Lima; CIP, OCH, from greenhouse plants at Huancayo). Below the housing complex and near the public park of the Toquepala Mine, 3000 m alt., 2 April 1977, *C. Ochoa 11610* (CIP, OCH, plants grown in the greenhouse at La Molina, Lima and in the greenhouse at Huancayo). Between Topapalca and Siete

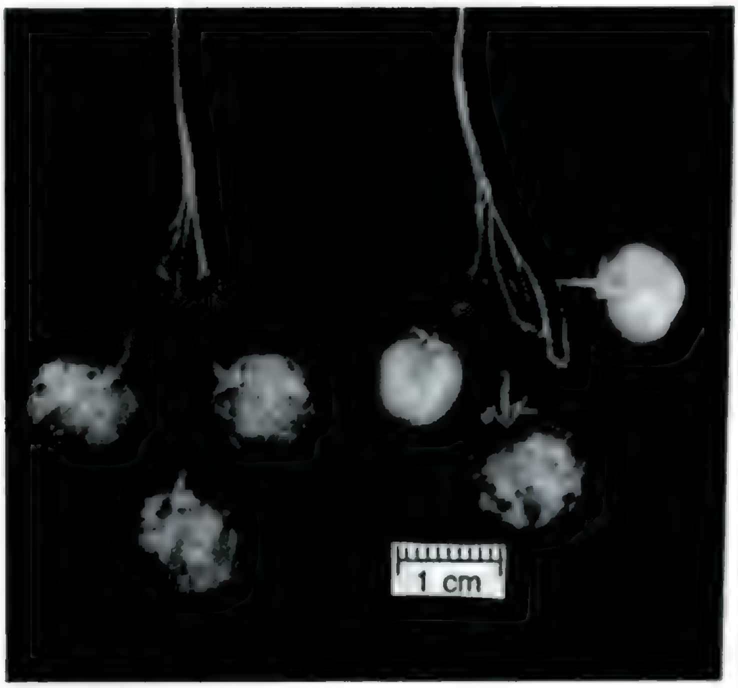


Figure 398. Fruits of *Solanum tacnaense* (*Ochoa 11609*).

Vueltas, 3450 m alt., along the route from Palca to Condor Pico, scarce, plants young, one in flower, corolla blue-violet, in the shade of *Dunalia* shrubs and protected by the columnar stems of *Oreocereus* sp., 3 March 1981, *C. Ochoa 14241* (OCH). Vicinity of the Toquepala Mine, 3200 m alt., in poor rocky soil, 4 March 1981, *C. Ochoa 14262*, 2n=24 (OCH topotype of *S. tacnaense*), and (CIP, MOL, OCH, plants grown in greenhouses at Huancayo and at La Molina, Lima); *14263* (OCH topotype, plants very young), and (CIP, MOL, OCH, plants grown at La Molina, Lima and in the greenhouse at Huancayo).

Province Tarata: Candarave, 2900-3000 m, perennial tuber-bearing herb, open formations, shrubs and Cereus, flowers violet, March 1925, A. Weberbauer 7379 (F two sheets, US). Ticalaco, 3150 m alt., near Tarata, in thickets and rocky foothills of a mountain, scarce, plants 30-35 cm tall, stem simple, leaves with 2-3 pairs of leaflets, the first upper pair decurrent at base, flowers blue-violet, 22 March 1953, C. Ochoa 2039 (OCH). Saillani, ca. 2600 m alt., near Talabaya, Tarata, 11 December 1962, floral dissection only, made at La Molina, Lima, 11 December 1962, C. Ochoa s.n. (OCH). Lower slopes of Cerro Antavilca, near Huanuara, 3450 m alt., about 10 km (in a straight line) south-southwest of Candarave, 4 March 1981, C. Ochoa 14260 (CIP, OCH, US).

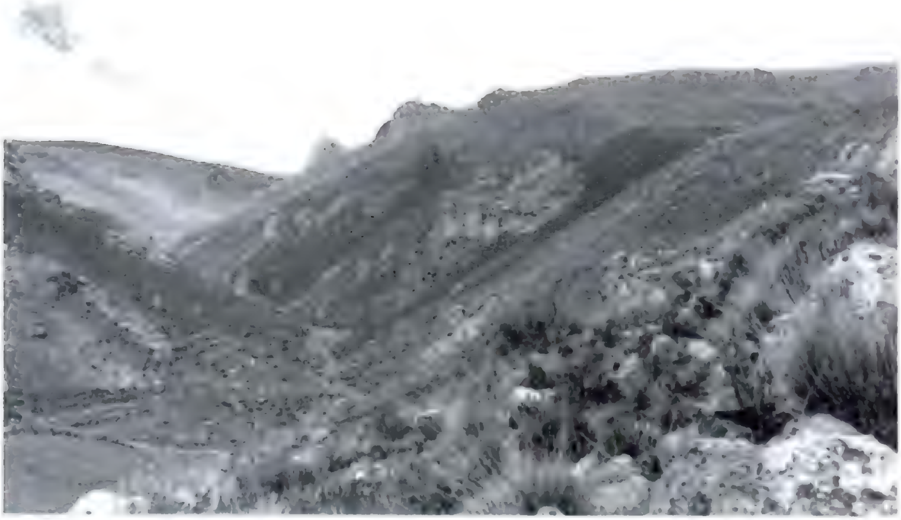


Figure 399. Habitat of *Solanum tacnaense* (*Ochoa 11609*), along the Tacna-Tacora road, 3450 m alt.

CHILE

Province Tarapacá, 1 km northwest of Chapiquiña, ca. 3200-3400 m alt., near lat. 18°22' S and long. 69°30' W, tubers only, without date, Luis Gómez and Abdón Tapia s.n. presented to C. Ochoa in April 1982 (OCH, plants reproduced from tubers in the greenhouse at Huancayo, January 1983). Chromosome Number: 2n=24.

Breeding Potential

The results of crosses of S. tacnaense with diploid species (2n=24) of EBN=1 and EBN=2 and triploids (2n=36) are given in Table 100, while the materials used in these experiments are shown in Table 101.

Only one reciprocal cross involving *S. tacnaense* and a diploid species having an EBN value of 1 yielded fertile seed, and that was in the case of *S. Mochiquense* when used as a pistillate parent. The other attempted crosses, involving the species *S. hypacrarthrum*, *S. immite* and *S. wittmackii*, were all unsuccessful.

At the EBN=2 level, *S. tacnaense* proved to be compatible in reciprocal crosses with the diploid species *S. bukasovii* and *S. multiinterruptum*. It was also greatly compatible with diploid accessions of *S. medians*, but not at all with its triploid forms.

Table 100. Fertility of *Solanum tacnaense* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	PIURANA	× *S. hypacrarthrum*	9(14)	2(13)	0(0)
24	1	TUBEROSA	× *S. immite*	5(11)	4(9)	0(0)
			× *S. mochiquense*	23(42)	6(40)	0(28)
			× *S. wittmackii*	12(9)	0(0)	0(0)
24	2	TUBEROSA	× *S. bukasovii*	10(16)	8(13)	27(88)
			× *S. medians*-2x	8(4)	2(1)	50(130)
			× *S. multiinterruptum*	7(9)	5(1)	2(5)
			× *S. sawyerii*	5	4	60
36	-	TUBEROSA	× *S. medians*-3x	7(27)	0(17)	0(0)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 101. Collections (OCH) used in *Solanum tacnaense* fertility studies.

PIURANA
S. hypacrarthrum 13272

TUBEROSA
S. bukasovii 14333, 14355, 14372, 14381, 14383, 14404
S. immite 11689
S. medians-2x 11884, 13268
S. medians-3x 11878, 13141
S. mochiquense 14870
S. multiinterruptum 11690, 12055
S. sawyerii 13698
S. tacnaense 11609, 11610, 11611, 11612, 14262
S. tacnaense f. *decurrentialatum* 14261
S. wittmackii 13215

83a. ***Solanum tacnaense*** Ochoa f. ***decurrentialatum*** (Ochoa) Corr., Wrightia 197, 1961.

Fig. 400; Map 29.

S. weberbaueri Bitt. var. *decurrentialatum* Ochoa, Agronomía, Lima, 26(3):219-220, illustr., 1959. Type: PERU. Department Tacna, Province Tarata, Cerro Ticalaco, 3200 m alt., near Tarata, 22 March 1953, C. *Ochoa 2040* (OCH).

S. tacnaense Ochoa f. *decurrentialatum* (Ochoa) Corr. Type: based on C. *Ochoa 2040.*

This form resembles the typical species in general aspect and habit, as well as in its coarsely and densely pubescent leaflets. However, it differs from the typical form in lacking interjected leaflets and in having only 1-2(-3) pairs of lateral leaflets, and in having terminal leaflets that are larger than the laterals. Moreover, the first pair of lateral leaflets of this form are broadly decurrent about the rachis, forming a broad cuneate wedge which descends from the basiscopic side of the base. Also, the second upper pair of lateral leaflets of this form are either sessile or subsessile or are much more narrowly decurrent upon the rachis than in the typical species.

Through its narrow leaflets and by the conspicuous decurrency of its first upper pair of leaflets, *forma decurrentialatum* shows some relationship with *S. sandemanii*.

Specimens Examined

Department Tacna

Province Tarata: Ticalaco, rocky foothills of Cerro Ticalaco, 3200 m alt., near Tarata, flowers blue, plants 20-30 cm tall, 22 March 1953, C. *Ochoa 2040*

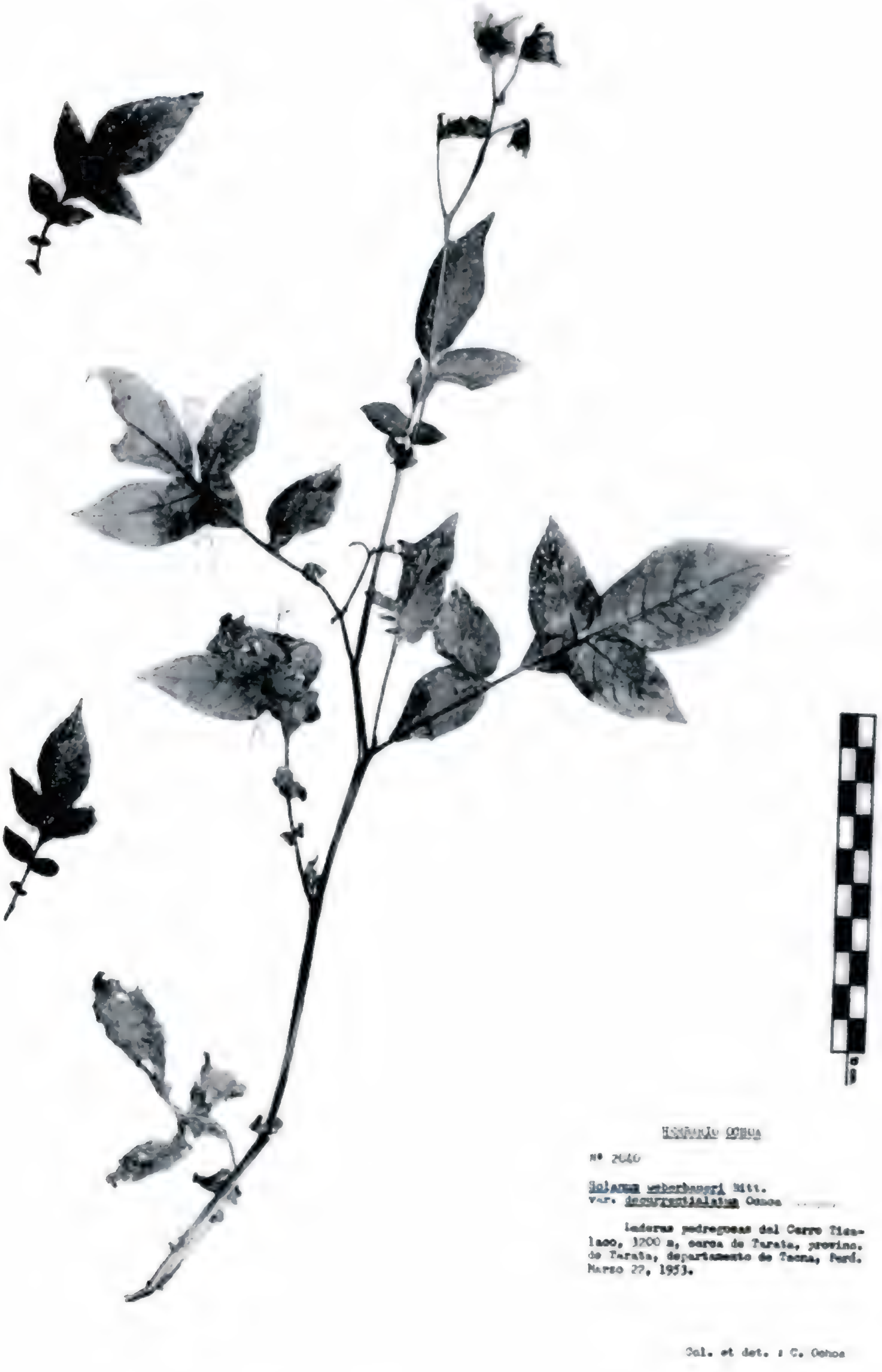

Herbario Ochoa
Nº 2040
Solanum weberbaueri Bitt.
var. decurrentialatum Ochoa
Laderas pedregosas del Cerro Tica-
laco, 3200 m, cerca de Tarata, provinc.
de Tarata, departamento de Tacna, Perú.
Marzo 27, 1953.
Col. et det. : C. Ochoa

Figure 400. *Solanum tacnaense* f. *decurrentialatum (Ochoa 2040*, type collection of "*S. weberbaueri* var. *decurrentilatum*").

(OCH, type collection of *S. tacnaense* f. *decurrentialatum*). Lower slopes of Cerro Antavilca, near Huanuara, 3450 m alt., about 10 km (in a straight line) south-southwest of Candarave, 4 March 1981, *C. Ochoa 14261*, 2n=24 (CIP, OCH).

84. *Solanum tapojense* Ochoa, Phytologia 46(4):223, 1980.

Figs. 401; Map 30.

Plant erect, 30-50 cm tall, sparsely pubescent; stem 3-5 mm in dia. at base, simple or branched, narrowly winged, slightly pigmented, somewhat pilose, hairs very short, white, internodes 3-6(-8) cm long. Stolons to more than 1 m long and 1.5-2.0 mm in dia., whitish; tubers round to ovoid, whitish-yellow, 2-3 cm long, flesh white. Leaves short and broad, 10.5-14.5(-17.0) cm long by 8.5-9.0(-10.5) cm wide, imparipinnate, with 3-4 pairs of leaflets and 0-1 pair of interjected leaflets, petioles up to 3-5 cm long. Leaves dark green, more or less sparsely pubescent on the upper surface including the rachis, petioles and petiolules with very short, white, adpressed hairs and light green and somewhat less pubescent below, the veins and veinlets pubescent, and the petioles, petiolules and axils covered with very small tetralobular glandular hairs, principally at their base. Terminal leaflets elliptic-lanceolate, somewhat longer and wider than the adjacent lateral leaflets, 5-7 cm long by 2.5-4.0 cm wide, with subpointed to obtuse tips and attenuate to rounded bases; lateral leaflets elliptic-lanceolate to oblong-lanceolate or oblong-elliptic, with mostly obtuse tips and obliquely obtuse bases, sessile or subsessile, the first pair of lateral leaflets 3.5-5.0 cm long by 1.7-2.5 cm wide, somewhat decurrent about the rachis; leaflets of the last lower pair notably smaller. Interjected leaflets, when present, orbicular, very small, 1-2 mm in dia., sessile. Pseudostipular leaves broadly falcate or auriculate, up to 10 mm long by 5 mm wide. Inflorescence cymose, 15-25-flowered; peduncle 8-11 cm long by 1.5-2.0 mm in dia., sparsely pubescent or puberulent as in the case of the pedicels; pedicels 15-25 mm long, articulated 4-5 mm below the base of the calyx. Calyx asymmetrical, 6.5-7.0 mm long, densely pubescent; lobes narrowly elliptic-lanceolate, margins scarious, abruptly acuminate, acumens pointed, 2-4 mm long. Corolla rotate, small, 2.0-2.8 cm in dia., violet to violet-lilac, with a yellowish-green internal star, acumens short, with broad bases and densely puberulent margins. Staminal column asymmetrical, anthers broadly lanceolate, 5.0-5.5 mm long, base cordate; filaments white, 1.0-1.5 mm long, glabrous. Style 9 mm long, exerted 2.5-3.0 mm, densely papillose below center; stigma oval-capitate. Fruit round to ovoid, uniformly light green, up to 2.5 cm long. Chromosome Number: 2n=24. EBN=2.

Local Name: *Apharuma*

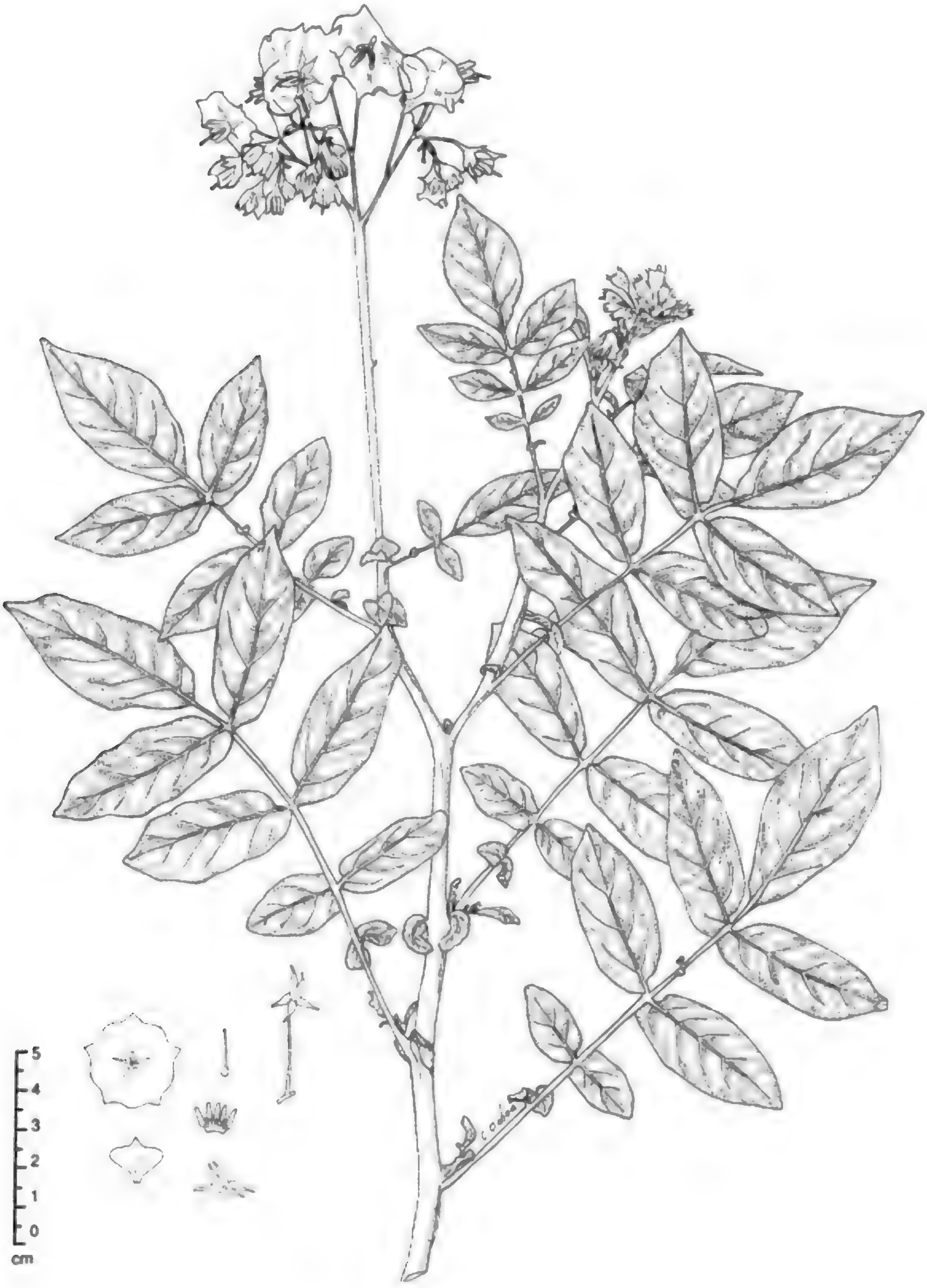


Figure 401. *Solanum tapojense* (*Ochoa 2789*, holotype).

Type: PERU. Department Puno, Province Yunguyo [formerly Chucuito], between Tapoje and Maucache, 3850 m alt., in grasslands of *Stipa ichu*, March 1970, *C. Ochoa 2789* (holotype OCH, isotypes MOL, USM).

Affinities

This species is unique with respect to its leaf and leaflet shape, as well as in the form of its calyx and the entire general aspect of the plant. Although superficially similar to *S. leptophyes*, it would not appear to be closely related to this plant or to any other species.

Habitat and Distribution

Solanum tapojense grows amongst stones in *Stipa ichu* grasslands. It is associated with *Astragalus*, *Cajophora*, *Solanum acaule* and very few other species. Presently, this species is known only from the high mountains and *punas* of the *altiplano* near the south-southwest shores of Lake Titicaca, where it grows at elevations of 3830 to 3850 m (Map 30).

Specimens Examined

Department Puno

Province Yunguyo [formerly Chucuito]: In *puna,* between Tapoje and Maucache, 3850 m alt., between large rocks and tufts of *Stipa ichu* associated with *Astragalus* sp., *Cajophora* sp. and *S. acaule*, n.v. *Apharuma*, March 1970, *C. Ochoa 2789* 2n=24 (MOL, OCH, USM, type collection of *S. tapojense*). Near Tapoje, 3830 m alt., in puna grasslands, December 1977, *C. Ochoa and A. Salas 11821*, 2n=24 (OCH), (CIP, OCH, plants propagated in the greenhouse at Huancayo) and (CIP, OCH, from plants propagated at La Molina, Lima). Near Maucache, 3845 m alt., in *puna* grassland, February 1984, *C. Ochoa and A. Salas 15453*, 2n=24 (OCH).

Breeding Potential

The results of crosses of *S. tapojense* with diploid species (2n=24) of EBN=2 are given in Table 102, while the materials used in these experiments are shown in Table 103.

Solanum tapojense is self-incompatible. In reciprocal crosses with *S. bukasovii* and *S. sparsipilum* of Series Tuberosa and *S. raphanifolium* of Series Megistacroloba, large numbers of seeds were obtained. However, reciprocal crosses with *S. leptophyes* of Series Tuberosa were successful only when the latter species was used as the pistillate parent. No seeds at all were obtained in the unilateral crosses that were attempted between this species and *S. marinasense* and *S. multiinterruptum* of Series Tuberosa, and *S. chiquidenum* of Series Piurana.

Table 102. Fertility of *Solanum tapojense* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	2	MEGISTACROLOBA	× *S. raphanifolium*	13(3)	9(2)	61(150)
24	2	PIURANA	× *S. chiquidenum*	5	3	0
24	2	TUBEROSA	× *S. bukasovii*	14(14)	11(9)	61(167)
			× *S. leptophyes*	7(3)	5(2)	67(28)
			× *S. marinasense*	4	1	0
			× *S. multiinterruptum*	6	1	0
			× *S. sparsipilum*	15(31)	10(24)	67(323)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 103. Collections (OCH) used in *Solanum tapojense* fertility studies.

MEGISTACROLOBA	TUBEROSA
S. raphanifolium 13759	*S. bukasovii* 13542, 14333
	S. leptophyes 13671, 13731, 13733
PIURANA	*S. marinasense* 13673
S. chiquidenum 13963	*S. multiinterruptum* 14696
	S. sparsipilum 8358, 11822, 12035, 13697, 13786
	S. tapojense 11821

85. ***Solanum tarapatanum*** Ochoa, An. Cient. Univ. Nac. Agr., Lima 15(1-4), 1977.

Figs. 402-404; Map 27.

Plant erect, slender, 15-30 cm tall, sparsely pilose, light green; stem simple or branched, woody or subwoody along the basal one-third of its length, cylindrical, very slender, 2-4 mm in dia. at base, light green or slightly pigmented, sparsely pubescent, very narrowly and inconspicuously straight winged or wings absent; internodes short, 1-2 cm long. Stolons up to 1 m or more long, slender; tubers small, 1-2 cm long, round to ovoid, white. Leaves light green, long and narrow, delicate, 12.5-16.0 cm long by 5.0-6.5 cm wide, imparipinnate, with 5-6(-7) pairs of leaflets and 5-7(-10) pairs of interjected leaflets; rachis very fine and slender, slightly pigmented. Leaflets narrowly lanceolate and pointed at tip, sparsely pubescent above, including on the rachis and petiolules and somewhat more densely pubescent or puberulent on the mesophyll below; terminal leaflets nearly the same size as the first upper pair of laterals, 2.5-3.2 cm long by 0.7-0.9 cm wide, with long-attenuate or cuneate bases; the second upper pair of lateral leaflets slightly larger than both the terminal leaflet and the first upper pair, 2.9-3.4 cm long by 0.9-1.0 cm wide, with long-attenuate, symmetric or slightly oblique bases like the remaining lateral leaflets, on petiolules 2-5 mm long. Pseudostipular leaves narrowly lanceolate or subfalcate to falcate, small, 4-6 mm long by 2.0-2.5 mm wide. Inflorescence cymose, 10-12-flowered; peduncle 8-10 cm long, slender, 1.5-2.0 mm in dia., sparsely pubescent; pedicels 15-25(-30) mm long, densely puberulent, articulated near center or slightly below the midpoint, or about 10-12 mm below the base of the calyx. Calyx symmetrical, 5-6 mm long, densely pubescent, hairs very short and adpressed; lobes ovate, the margins broadly scarious at base, attenuate toward the obtuse or subpointed apex. Corolla rotate to rotate-pentagonal, 2.5-3.0 cm in dia., light purple or pale violet, with a dark gray internal star. Anthers broadly lanceolate, small, 4.0-5.5 mm long. Style 9 mm long, exerted 2.5 mm; stigma claviform, cleft. Fruit round or obovate, 10-12 mm in dia., pure green or lightly marked with vertical violet stripes. Chromosome Number: 2n=24.

Local Name: *Llutt'u Papa* (Partridge Potato).

Type: PERU. Department Cusco, Province Urubamba, vicinity of Tarapata, 2600-2800 m alt., on xerophytic hillsides, April 1953, C. *Ochoa 2064* (holotype OCH, isotypes MOL, USM).

Affinities

This species is related to *S. leptophyes*. Both species have small, bushy stems, leaves of similar dissection and narrow leaflets. However, *S. tarapatanum* differs

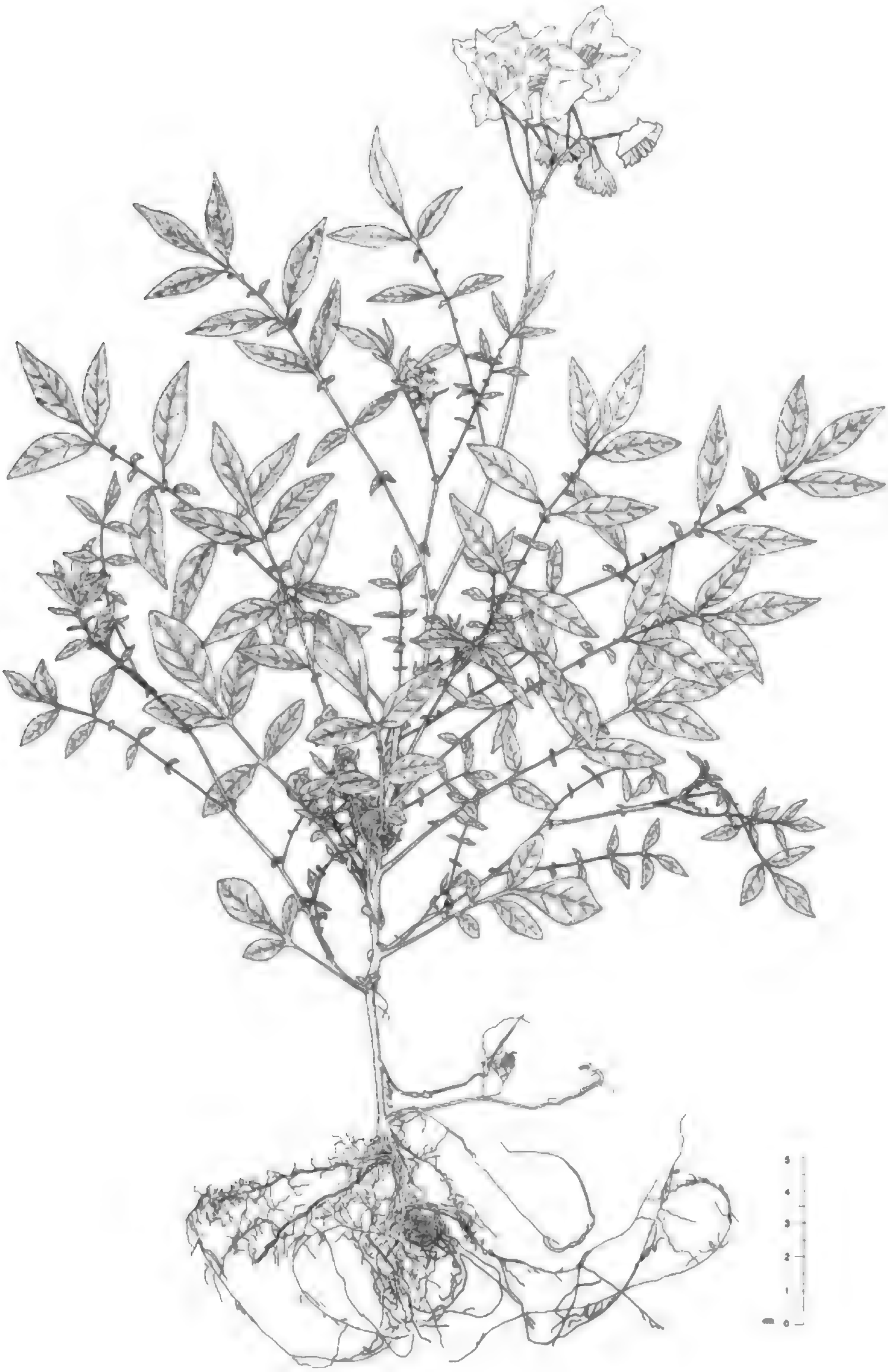


Figure 402. *Solanum tarapatanum* (*Ochoa 2064*, holotype).

from *S. leptophyes* in having a more slender, delicate and subwoody stem, a much finer pubescence and a lower point of pedicel articulation.

Habitat and Distribution

Solanum tarapatanum grows in poor, rocky-clay or lateritic soil on dry hillsides. It is associated with columnar cacti (*Corryocactus* sp.), prickly-pears (*Opuntia ficus-indica*), shrubs (*Dunalia lycioides*) and various herbs (*Oenothera* sp., *Alternanthera* sp., etc.).

As far as known, this species is endemic to the mountains of Tarapata in the Province of Urubamba, Department of Cusco in southern Peru, where it grows at elevations between 2600 and 2900 m (Map 27). Unfortunately, this species appears presently to be either completely extinct or on the verge of extinction. The author has returned on several occasions to the type locality but has not found this

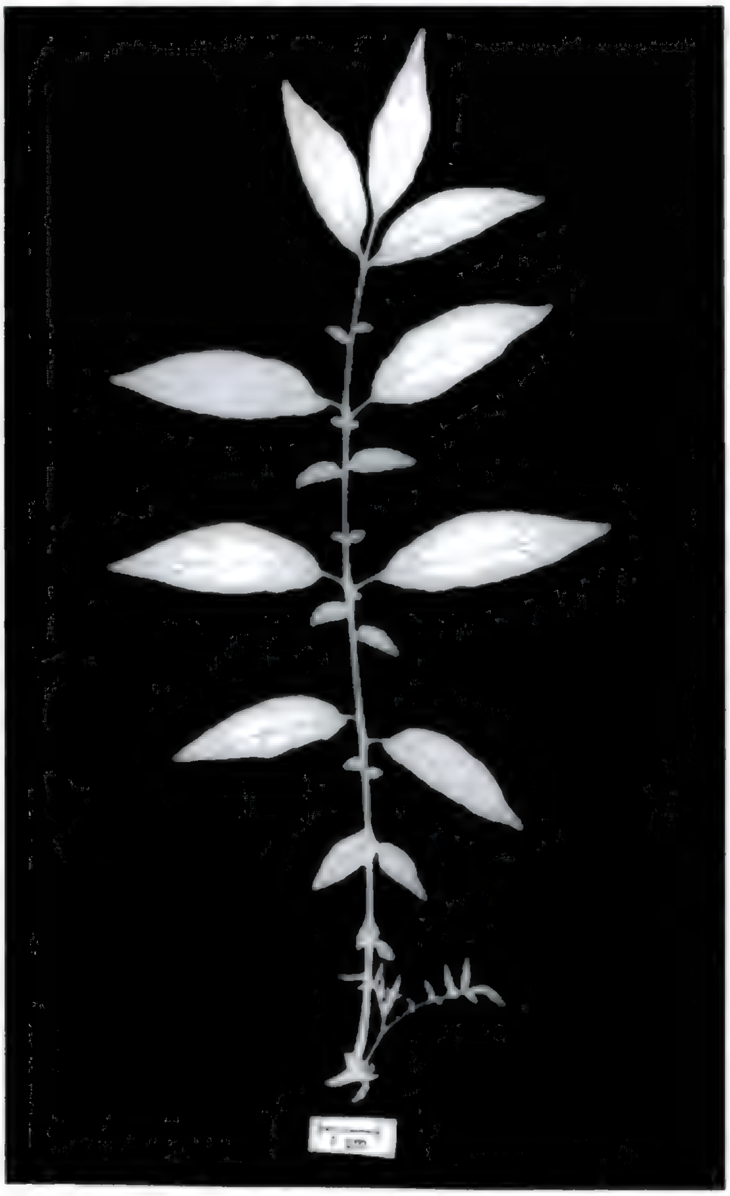


Figure 403. Leaf of *Solanum tarapatanum* (*Ochoa 2064*, holotype).

species again. Several factors have probably led to the eradication of this species' habitat, including an invasion by *Penicetum clandestinum*, highway construction and the spread of noxious fumes from a nearby chemical plant.

Specimens Examined

Department Cusco

Province Urubamba: Vicinity of Tarapata, 2600-2800 m alt., on xerophytic hillsides, April 1953, *C. Ochoa 2064* (MOL, OCH, USM, type collection of *S. tarapatanum*). On rocky slope of mountain above Urubamba, 3000 m alt., flowers deep lavander, rotate, February 27 1958, *D.S. Correll, E.E. Smith and C. Vargas C. P232* (LL, UC). On steep hillsides above Tarapata, 2900 m alt., among columnar cacti and spiny shrubs, n.v. *Llutt'u Papa* (Papa de Perdiz), 5 May 1975, *C. Ochoa 7599*, 2n=24 (topotypes CIP, OCH).

Breeding Potential

This species is self-incompatible. A large average number of seeds per fruit (ca. 280) were obtained in unilateral crosses of *S. tarapatanum* (*OCH 2064* and *OCH 7599*) with *S. phureja* (*OCH 14232* and *OCH 14233*).

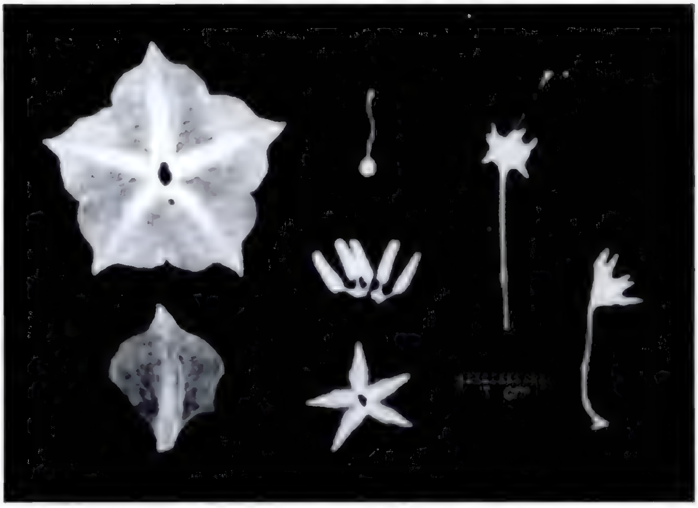


Figure 404. Floral dissection of *Solanum tarapatanum* (*Ochoa 2064*, holotype).

86. *Solanum taulisense* Ochoa, Lorentzia 4:13-15, Cordoba, Argentina, 1981.

Figs. 405-406; Map 8.

Plant erect, small, 15-25 (-35) cm tall, sparsely pubescent. Stem simple or branched, slender, 3-5 mm in dia. at base, slightly pigmented, somewhat flexuous, sparsely and very shortly pilose, very narrowly and inconspicuously straight winged. Stolons to 40 cm or more long by 1 mm in dia.; tubers globose to ovoid or long-subcylindrical, very small 6-10(-30) mm long, white or tinged with violet stripes, borne singly along the length of the stolon or moniliform. Leaves 8.5-16.0 cm long by 3-7 cm wide, imparipinnate, with 3-4 pairs of lateral leaflets and 0-2 pairs of interjected leaflets, sparsely pilose above and less densely pilose or puberulent below especially on the veins and veinlets. Terminal leaflets more broadly elliptic and larger than the laterals, 3-4 cm long by 2.0-2.6 cm wide, with subobtuse or pointed tips and long-cuneate bases; lateral leaflets elliptic or narrowly elliptic, sessile or subsessile, diminishing gradually in size at base, the first upper pair 2.0-3.5 cm long by 1.0-1.6 cm wide. Interjected leaflets, when present, very small, 1-3 mm long, orbicular or elliptic, sessile. Pseudostipular leaves subfalcate, 3-5 mm long by 1.5-3.0 mm wide. Inflorescence cymose to cymose-paniculate, 3-7-flowered; peduncle (1.5-)4-6 cm long, slightly pigmented, sparsely pilose as in the case of the pedicels and the calyx; pedicels 15-25 mm long; articulated at the midpoint or above center. Calyx symmetrical, pigmented, small, 5.0-5.5 mm long, lobes elliptic-lanceolate to ovate-lanceolate, scarious at base and acuminate at apex, acumens 1.5-2.0 mm long. Corolla rotate, small, 2.0-2.5(-3.0) cm in dia., purple-violet, with a deep purple to grayish-violet internal star. Anthers lanceolate, small, 5.0-5.5 mm long, with deeply cordate bases; filaments to 2 mm long, purplish, glabrous. Style 8.5 mm long, exerted 1.5 mm, pigmented or slightly pigmented below center, densely covered with papillae and setose hairs along the lower two-thirds of its length; stigma shortly capitate, very small. Ovary pigmented purple. Fruit ovoid to pyriform, with obtuse apex, 24 mm long by 20 mm in dia. at the base, light green, with dark green venation. Chromosome Number: 2n=24.

Type: PERU. Department La Libertad, Province Pataz, Community of La Victoria, *jalcas* at Tauli, 3700-3800 m alt., 5 May 1967, *C. Ochoa 2654* (holotype OCH).

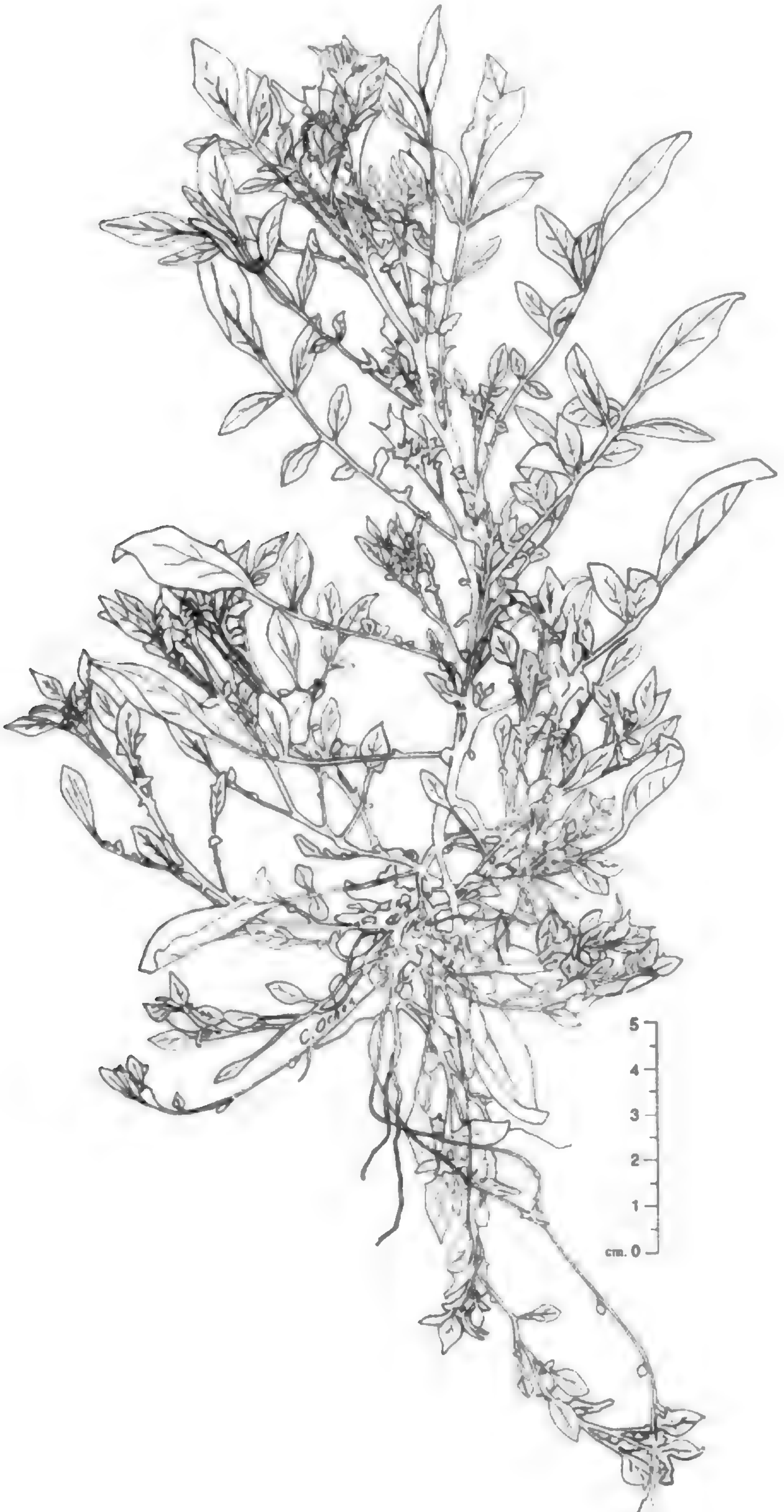


Figure 405. *Solanum taulisense* (*Ochoa 2654*, holotype).

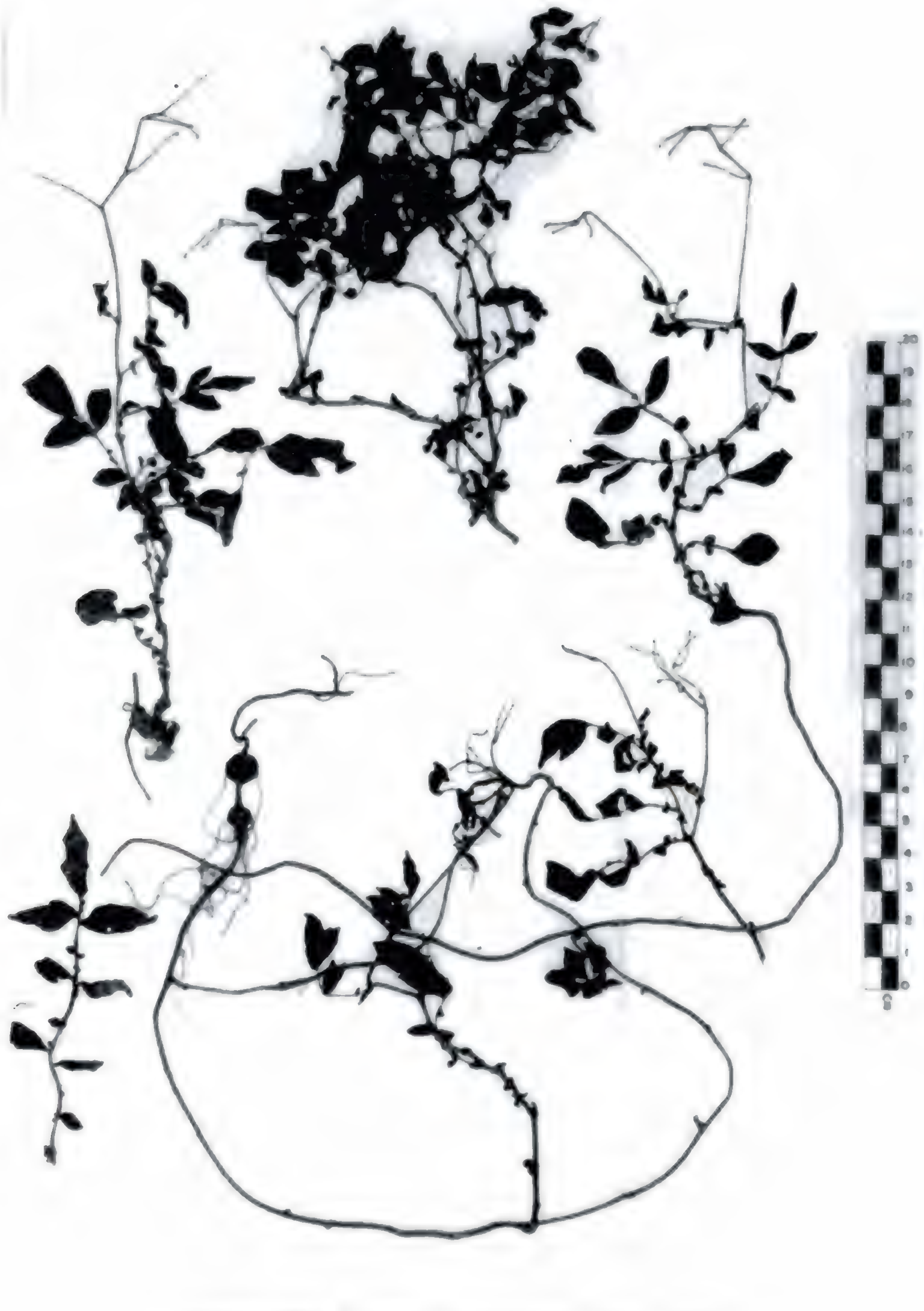


Figure 406. *Solanum taulisense* (*Ochoa 2956*).

Affinities

Solanum taulisense is related to some extent to *S. chomatophilum*. The two are alike in pedicel articulation, tuber formation and style and ovary coloration, and have similar appearing leaves and leaflets. However, *S. taulisense* differs markedly in overall pubescence, the smaller size of its corolla and the setose pilosity of its style, and by the differing shape of its fruit.

Habitat and Distribution

This species inhabits high, cool *jalca* regions. It grows in extensively distributed moist grasslands of *Stipa*, *Poa* and *Festuca*, or in small relic stands of trees and shrubs, these dominated principally by melastomes and various species of *Barnadesia* and *Polylepis*.

At present, *S. taulisense* is known only from the *jalcas* of Tauli, where it occurs at elevations ranging from 3700 to 3900 m along the old horse trail running between Gueishgue and Tocachi, in the south-southeast of the Province of Pataz, Department of La Libertad, in northern Peru (Map 8).

Specimens Examined

Department La Libertad

Province Pataz: *Jalcas* at Tauli, *ca*. 3700 m alt., Comunidad of La Victoria, 3700-3800 m alt., in very moist grasslands and relic stands of trees (= *Polylepis* sp.) and shrubs (*Barnadesia* sp.) and associations of *Calceolaria sp., Lupinus* and *Oxalis* sp., and others, 5 May 1967, *C. Ochoa 2654,* 2n=24 (OCH, type collection of *S. taulisense*). Highlands of Gueishgue, 3900 m alt., *jalcas* along the route to Tauli, 14 March 1971, C. *Ochoa 2956* (OCH).

87. ***Solanum trinitense*** Ochoa, An. Cient. Univ. Nac. Agr. La Molina, 2(3):245-247, illustr., 1964.

Figs. 407-409; Map 26.

Plant robust, erect or erect-ascending, (40-)70-120 cm tall, subglabrous or very sparsely pilose, light green; stem (6-)8-12 mm in dia. at base, simple or branched, marked with pale light brown pigment in the basal one-third of its length, narrowly straight and sinuously winged, sparsely pilose, hairs to 3 mm long; internodes (1.5-)2.5-5.0 cm long. Stolons short, (10-)15-20 cm long; tubers oval-pyriform, compressed or long subcylindrical, with obtuse tips and slightly pointed bases, large, up to 8-10 cm long by 2.5-3.0 cm in dia., whitish-yellow. Leaves large, very divided, long and narrow, (9.0-)15.5-30.0(37.0) cm long by (4.0-)6.5-17.0(18.0) cm wide, imparipinnate, with (5-)6-7 pairs of lateral leaflets and numerous interjected leaflets, to (12-)18-25 pairs. Leaflets subglabrous or very sparsely pilose above, more pilose on the veins and veinlets below, lanceolate or narrowly elliptic-lanceolate, with pointed to shortly acuminate to subpointed or occasionally obtuse tips and crenulate margins and cuneate to oblique or symmetrical rounded bases, on petiolules 1-7 mm long. Terminal leaflets similar in form, or slightly rhombic-lanceolate and somewhat larger than the laterals, (3.9-)5.0-7.5 (-9.5) cm long by (1.5-)2.0-2.8(-3.0) cm wide, with cuneate bases and long petiolules (up to 20 mm or more long), usually with one or more pairs of interjected leaflets. First pair of lateral leaflets (3.0-)4.0-5.0(-6.5) cm wide by (1.0-)1.5-2.0 (-2.5) cm wide. Interjected leaflets of diverse size, from 1 mm to 15 mm long, sessile, semiorbicular, ovate to elliptic, situated in distinct positions from Unilaterally about the rachis to acroscopically or basiscopically and semi-basiscopically about the petiolules and angles of the lower side of the rachis, respectively. Pseudostipular leaves conspicuous, strongly falcate or slightly clasping, (12-)15-20 mm long by (4-)6-8 mm wide. Inflorescence cymose, terminal or lateral, (8-) 14-20-flowered; peduncle 4-8 cm long by 1.5-2.0 mm in dia., forked two to three times, sparsely pilose as in the case of the pedicels and calyx, hairs 1-2 mm long. Pedicels 20-30(-35) mm long, articulated (3-)5-6 mm below the base of the calyx. Calyx symmetrical or asymmetrical, light green, 8-10 mm long, lobes lanceolate, the apex abruptly acuminate, with pointed 3-5 mm long acumens. Corolla rotate, white, 3.5-4.0 cm in dia., with a pale yellow internal star, with short lobes (3-5 mm) and extremely short acumens (1.5 mm), and puberulent tips and margins. Anthers yellowish-orange, lanceolate, 5.5-6.0 mm long; filaments short, 0.4 mm long, white-hyalinous, glabrous. Style 10-11 mm long, exerted 2-3 mm, densely papillose along the basal one-third of its length; stigma claviform, very small, slightly enlarged at apex of the style. Fruit essentially globose or slightly ovoid (Fig. 409), 1.5-2.0 cm in dia., green, lightly flecked with white dots, not verrucose. Chromosome Number: 2n=24. EBN=1.

Type: PERU. Department Cajamarca, Province Contumazá, District Trinidad, vicinity of Hacienda San Lorenzo, 3450 m alt., 11 April 1963, C. *Ochoa 2486* (holotype OCH, isotype LE).

When grown under experimental field conditions, the berries of this species are globose or nearly round. This differs from the shape that was reported in the original diagnosis of this species, which was made from dried, pressed specimens.

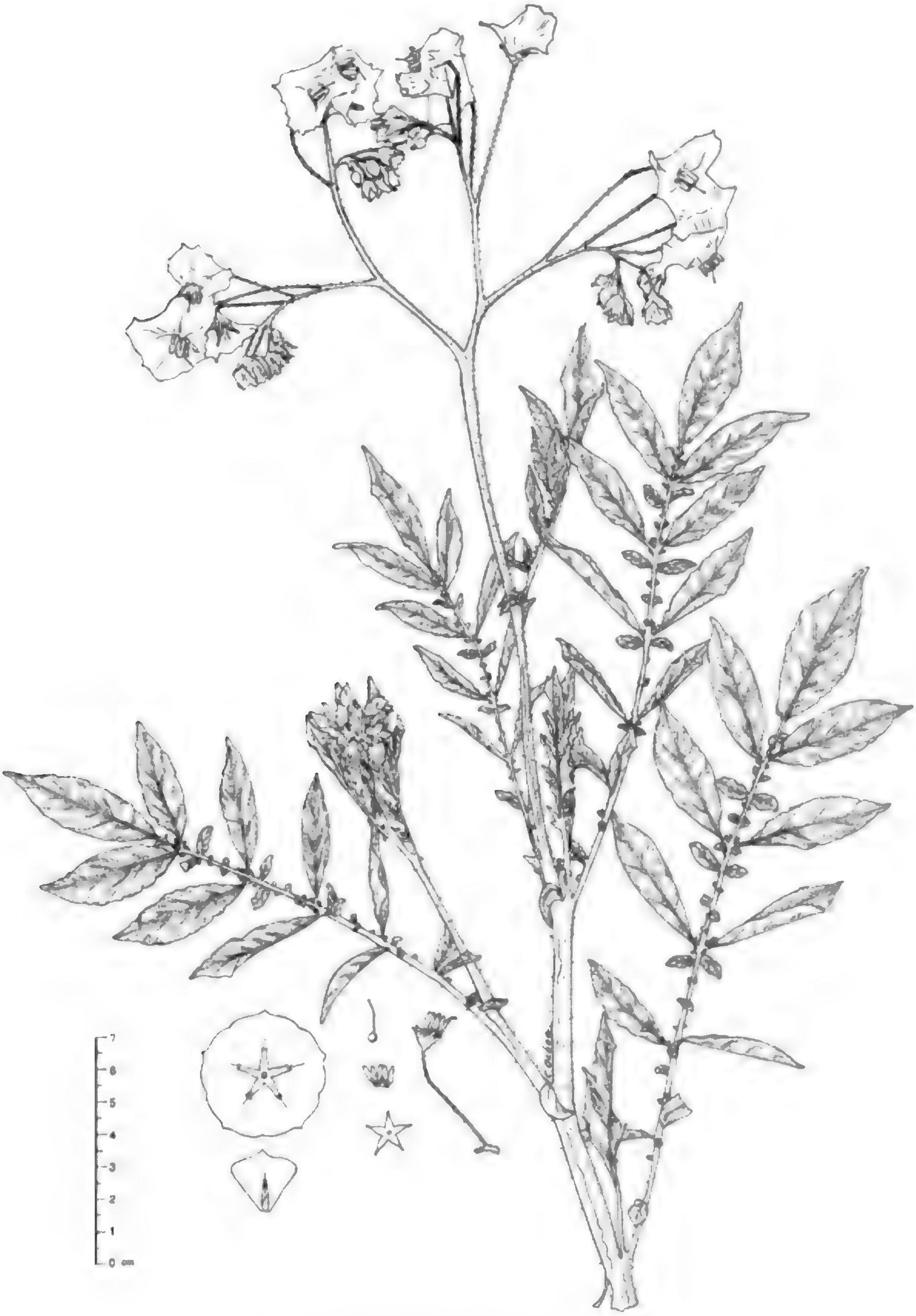


Figure 407. *Solanum trinitense* (*Ochoa 13968*).

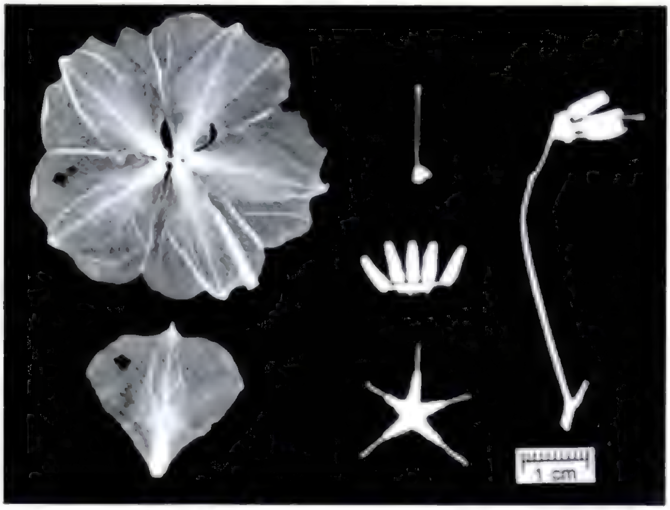


Figure 408. Floral dissection of *Solanum trinitense* (*Ochoa 13968*).

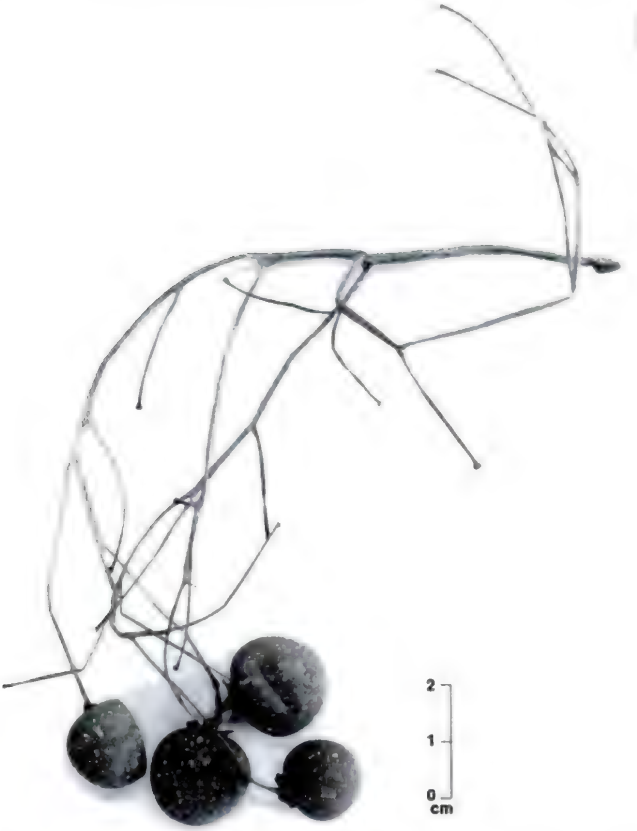


Figure 409. Fruiting racemes of *Solanum trinitense* (*Ochoa 13968*).

material

Affinities

Solanum trinitense is more closely related to *S. mochiquense* than to any other species. The two share a number of characteristics in common, including the light green color and vigorousness of the plant, large leaves, crenulate-margined leaflets, conspicuous pseudostipular leaves, and white, rotate corollas. However, *S. trinitense* differs from *S. mochiquense* in leaf dissection, leaflet shape, articulation of the pedicels and size and shape of the calyx and tubers.

Habitat and Distribution

This species grows in temperate to cool interandean valleys, generally at elevations between 2700 and 2850 m, though populations at 3400 m have been recorded. It has been collected from areas of subxerophytic vegetation and from small thickets of herbs and shrubs, the latter characterized by plants of the genus *Nicotiana*, as well as columnar cacti, grasses, composites and non tuber-bearing nightshades. It is also occasionally associated with other wild potato species, such as *S. chiquidenum* and *S. cajamarquense*.

This rare and interesting species appears to be endemic to the Province of Contumazá, Department of Cajamarca, in northern Peru (Map 26).

Specimens Examined

Department Cajamarca

Province Contumazá: District Trinidad, vicinity of Hacienda San Lorenzo, 3450 m alt., 11 April 1963, *C. Ochoa 2486* (OCH, LE, type collection of *S. trinitense*). Vicinity of Cajón, 2850 m alt., near Juque, along the route from Trinidad to San Lorenzo, growing with *S. chiquidenum*, tubers and cuttings were collected but not herbarium specimens, 10 May 1989, *C. Ochoa 13965* (OCH, plants propagated at La Molina, Lima from original cuttings). La Ciénica, *ca.* 3300 m alt., highlands of Hacienda San Lorenzo, walking upwards towards Juque, tubers white, long subcylindric, 4-5 cm long by 1.8 cm in dia., flowers white, growing near *S. chiquidenum*, 11 May 1980, *C. Ochoa 13966*, $2n=24$ (MOL, OCH, UNTC, USM). Cerro Chungarrán, 2850 m alt., near Guzmango, corolla white, conspicuously rotate, tubers ovoid, large, 8 cm long, 12 May 1980, *C. Ochoa 13968*, $2n=24$ (CIP, F, MOL, OCH, USM). Montaña de Clarín, 2700 m alt., along the pedestrian trail between Totorilla and Cholol, plants senescent, without flowers, amongst large rocks and other herbs such as begonia, nettle and various *Compositae*, growing near *S. cajamarquense*, 4 May 1995, *C. Ochoa and A. Salas 16252* (CIP, MOL, OCH).

Breeding Potential

Despite the fact that this species has an EBN value of 1, unilateral crosses of *S. trinitense* (*OCH 13968*) using pollen from *S. multiinterruptum* (*OCH 11691*) and *S. phureja* were highly successful.

88. *Solanum velardei* Ochoa, An. Cient. Univ. Nac. Agr., Lima 1(3):216-220, illustr., 1963. Figs. 410-412; Map 30.

Plant erect, (25-)30-45 cm tall, sparsely pubescent; stem usually simple, slightly flexuous, slightly pigmented in the basal one-third of its length, slender, 2-5 mm in dia. at base, sparsely puberulent, very narrowly and inconspicuously straight winged; internodes (1.5-)2.5-6.0 cm long. Stolons (20-)30-40 cm long; tubers whitish-yellow, round, small, 1-2 cm in dia. Leaves (4.0-)5.5-12.5(-14.0) cm long by (2.0-)3.5-8.5(-9.5) cm wide, imparipinnate, with (1-)2-3 pairs of lateral leaflets and 0-2 pairs of interjected leaflets, with densely pilose margins, hairs more or less sparsely distributed, fine and short above and more densely pubescent below. Terminal leaflets larger to much larger than the lateral leaflets, (2.5-) 3.5-7.5 cm long by (2.0-)2.7-4.5) cm wide, broadly ovate-lanceolate to ovate or suborbicular, with pointed or apiculate tips as in the case of the laterals and broadly rounded to cordate or truncate bases; lateral leaflets much narrower and elliptic-lanceolate, with pointed tips and obliquely rounded bases, sessile or shortly petiolulate, the first upper pair (0.5-)2.0-5.5 cm long by (0.3-)1.0-3.0 cm wide. Interjected leaflets, when present, very small, 1-5 mm long, orbicular to elliptic, sessile. Pseudostipular leaves narrow and asymmetrically elliptic or broadly falcate, small, 3.0-6.5 mm long by 2-4 mm wide. Inflorescence terminal or lateral, cymose; few flowered, with 3-6(-10) flowers; peduncle short, 2-3 cm long, light green and densely puberulent as in the case of the pedicels; pedicels 15-20(-25) mm long, articulated above center or about 4-5 mm below the base of the calyx. Calyx symmetrical, slightly pigmented, 7-8 mm long, pilose, lobes narrowly ovate-lanceolate or narrowly elliptic-lanceolate, attenuate toward the apex, acumens narrow, pointed, 2-3 mm long. corolla rotate to subpentagonal, blue, 3.0-3.5 cm in dia., acumens short, 2 mm long. Anthers narrowly lanceolate, 6 mm long, with cordate bases; filaments white-hyalinous, 1.5 mm long, glabrous. Style 10 mm long, exerted 2-3 mm, densely papillose along the lower two-thirds of its length; stigma capitate, small. Fruit subglobose to ovoid, 1.5 cm long. Chromosome Number: 2n=24.

Local Name: *Atokk papa* at Cotabamba, Apurimac.

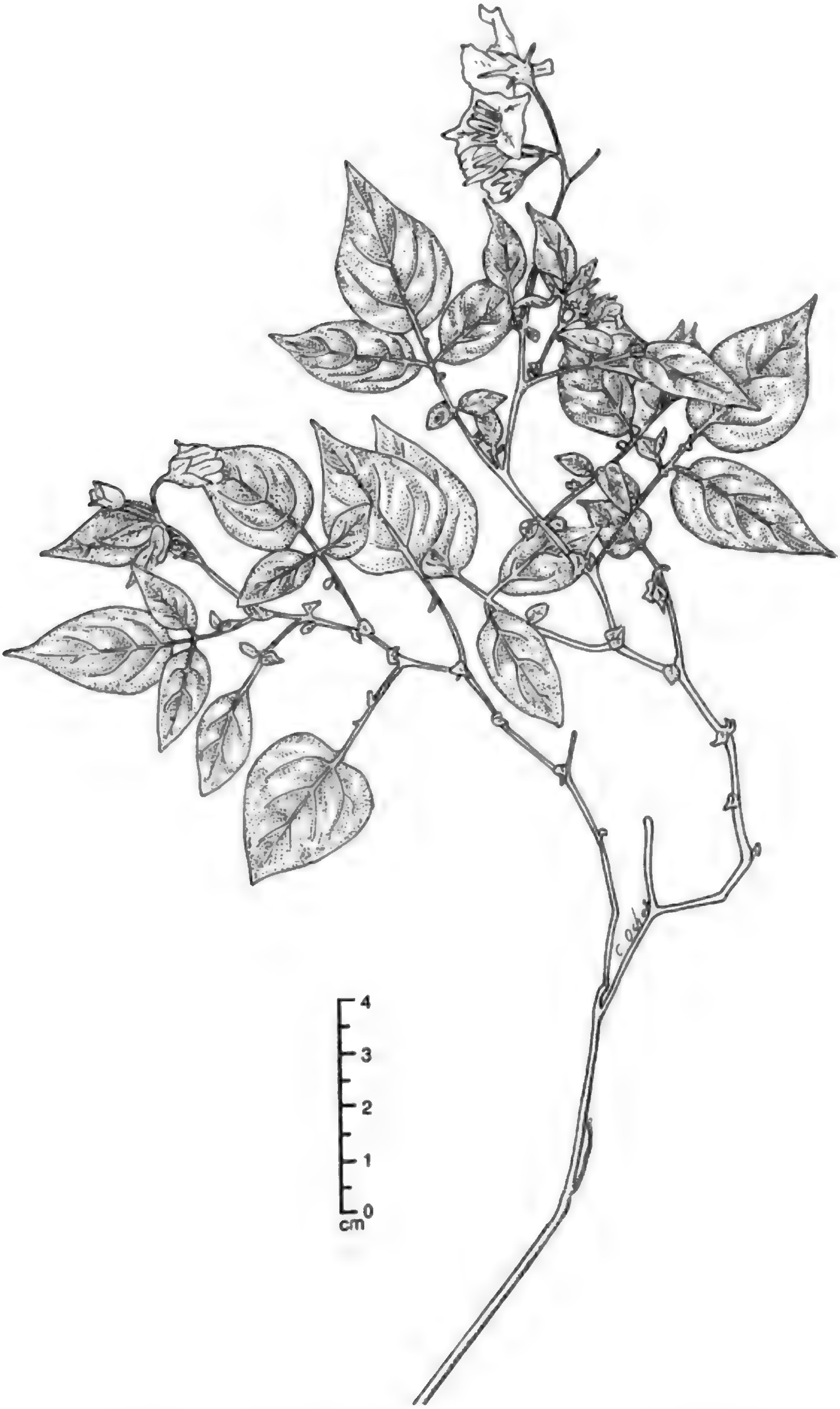


Figure 410. *Solanum velardei* (*Ochoa 2264*, near topotype).

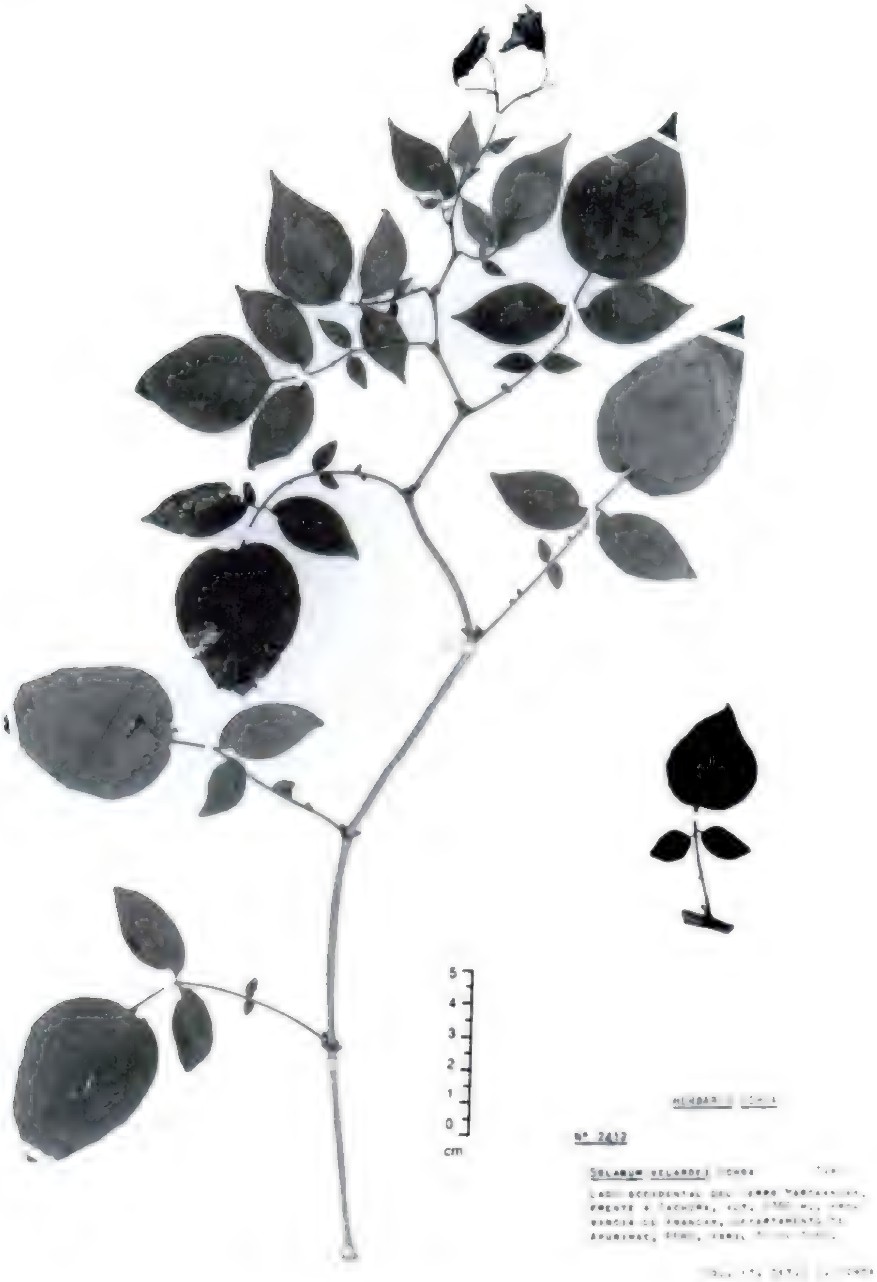


Figure 411. *Solanum velardei* (*Ochoa 2412*, holotype).

Type: PERU. Department Apurímac, Province Abancay, Cerro Marckancay, 2750 m alt., facing Cachora, 10 April 1962, C. *Ochoa 2412* (holotype OCH).

Affinities

Through its small plant size, leaf shape and dissection, *S. velardei* shows some relationship to *S. huancavelicae*, a species only recently described for central Peru.

Habitat and Distribution

This species grows in soils of very diverse composition. These range from soils that are rich in organic materials to ones that are poor and rocky. It grows preferentially in temperate xerophytic or subxerophytic valleys, generally at altitudes

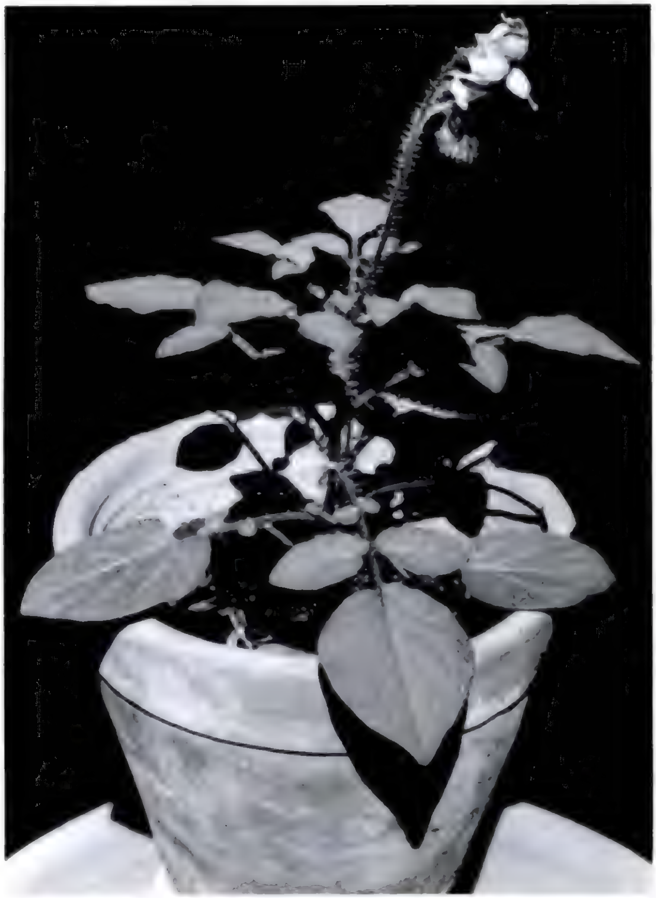


Figure 412. Living plant of *Solanum velardei* (*Ochoa* 2264).

between 2400 and 2900 m, although some populations occur in the higher and cooler mountain zones at altitudes ranging between 3000 and 3400 m.

The major area of distribution for this species lies in the Province of Abancay, Department of Apurímac, in southern Peru. However, a few smaller populations of this species occur in the Provinces of Antabamba, Cotabambas and Grau of the same department (Map 30).

Specimens Examined

Department Apurímac

Province Abancay: Going down the path from Cachora to the Apurímac River, 2450-2500 m alt., 17 February 1960, C. *Ochoa 2264* (OCH). Near Huanipaca, ca. 2900 m alt., 20 February 1960, *C. Ochoa 2268* (OCH). Between Cotabambas and Huanipaca, 2500 m alt., walking up via Tambobamba, 20 February 1960, C. *Ochoa 2269* (OCH). Lower slopes of Cerro Marckancay, facing Cachora, 2750 m alt., growing near *S. coelestispetalum*, 10 April 1962, C. *Ochoa 2412* (OCH, type collection of *S. velardei*). Rumi Cruz, *ca*. 2800 m alt., along the route from Cachora to Poyoncco, plants tender, sterile, scarce, 21 April 1975, C. *Ochoa 7676* (OCH). Near Saywapata, 2900 m alt., along the route Cachora-Poyancco, plant very tender, sterile, scarce, 21 April 1975, C. *Ochoa 7677* (OCH). District of Cachora, Jatun Ujo, 2800 m alt., among shrubs of tayanca (*Berberis* sp.), scarce, only very young plants, sterile, 21 April 1975, C. *Ochoa 7706* (OCH). About 7 km from Cachora, along the route to Incahuasi, 2900 m alt., 4 April 1975, R. *Ortega S-1* (OCH). About 9 km from Cachora, along the route to Incahuasi, 3190 m alt., 4 April 1975, *R. Ortega S-2* (OCH). Near Cotabamba, *ca*. 3200 m alt., above Kkanchirwuaylla, about 10 km west of Cachora and 6 km south of Tambobamba, in a moist forested quebrada, only tubers were collected, n.v. *Atokk papa*, 4 April 1975, *R. Ortega S-6* (OCH) and (OCH, plants propagated from tubers at La Molina, Lima). Near Huayracalle Gorge, 3400 m alt., along the route to Cachora, very rare, 19 March 1981, C. *Ochoa 14343* (CIP, OCH). Chuchainiocc, 3350 m alt., between Huayracalle Gorge and Cachora, March 1981, *C. Ochoa 14344* (CIP, OCH).

Province Antabamba: Left bank of the Pachaconas River, heading down towards Alcopay, 2600 m alt., 30 March 1980, C. *Ochoa 14387* (CIP, OCH, plants propagated from seed at La Molina, Lima).

Province Cotabambas: Ccochapata, 3000 m alt., heading down from Cotabambas to the Apurímac River, subxerophytic region, gravelly soils, February 1980, C. *Ochoa 13688* (CIP, MOL, OCH, US, USM).

Province Grau: Huacansagua, 2600 m alt., subxerophytic valley between Chuquibambilla and Vilcabamba, along the horse trail to Ayrihuanca, among shrubs of *Agave* and colonies of *Opuntia ficus-indica*, 26 February 1960, *C. Ochoa 2231* (OCH).

89. ***Solanum wittmackii*** Bitt., Fedde Repert Sp. Nov. 12:54-56. 1913.

Figs. 413-426; Map 24; Plate XXXVI.

*S. **tuberosum*** L. var. ***macranthum*** Hook., f., Fl. Antarct. 2:330. 1847.
S. wittmackii var. *glauciviride* Bitt., Fedde Repert. 12:56. 1910.
S. vavilovii Juz. et Buk., Bull. Acad. Sci. U.S.S.R. Ser. Biol. 2:302-303. 1937.

Plant robust, erect or ascending, (25-)40-70(-90) cm tall, grayish-green, odoriferous, glandular, stoloniferous and tuber-bearing; stem simple or little-branched, cylindrical, flexible, covered with short tetralobular glandular hairs and simple, silvery-white and silky multicellular hairs 4-5 mm long, as in the case of the petiolules and the rachis; internodes (1.5-)2.5-5.5(-6.5) cm long. Stolons 1.0-1.50 m or more long, tubers white, usually falcate or fusiform but occasionally round or ovoid, moniliform, subcylindrical, 6-8 cm long by 2-3 cm thick. Leaves imparipinnate, (10-)14-26(-35) cm long by (6.0-)7.5-13.5(-16.5) cm wide, strongly dissected with (5-)6-8(-9) pairs of leaflets and numerous interjected leaflets (7-) 12-18, or up to 25 pairs of different size, frequently recurved, on petioles 1.5-2.5(-3.5) cm long; leaflets narrowly lanceolate, with pointed or shortly acuminate tips and rounded to cuneate bases, sessile or shortly petiolulate, margins entire and pilose, terminal leaflets nearly the same size as the first upper pairs, (2.5-3.5)5.0-6.5(-8.0) cm long by (1.0-1.5)2.0-2.5 cm wide, the leaflets of the second to the fourth upper pairs always larger than the terminal and those of the first upper pair, (3.0-4.0-)6.0-7.5(-8.5) cm long by (2.0-)2.5-3.0 cm wide, the remaining pairs of leaflets gradually diminishing in size toward the base; interjected leaflets varying from (0.6-)2.0-2.8 cm long by (0.3-)0.8-1.2 cm wide; leaflets sparsely covered by long simple hairs and short glandular trichomes on both sides and more densely pilose on the veins and veinlets below. Pseudostipular leaves broadly falcate, clasping, 1.0-2.5 cm long by 0.5-1.2 mm wide. Inflorescence terminal or lateral, cymose-paniculate, (7-)15-25(-35)-flowered; peduncle robust, short, 4.5-5.0(-8.0) cm long; pedicels (2-)3-4(-5) cm long, articulated in the upper one-third of their length or slightly above center, or approximately 15-18 mm below the calyx; peduncle and pedicels sparsely glandular-pilose. Calyx (7-)9-12 mm long, pilose, abruptly narrowed to linear-spatulate or narrowly spatulate acumens 3-4 mm long. Corolla showy, rotate or pentagonal, large, 3.5-4.0

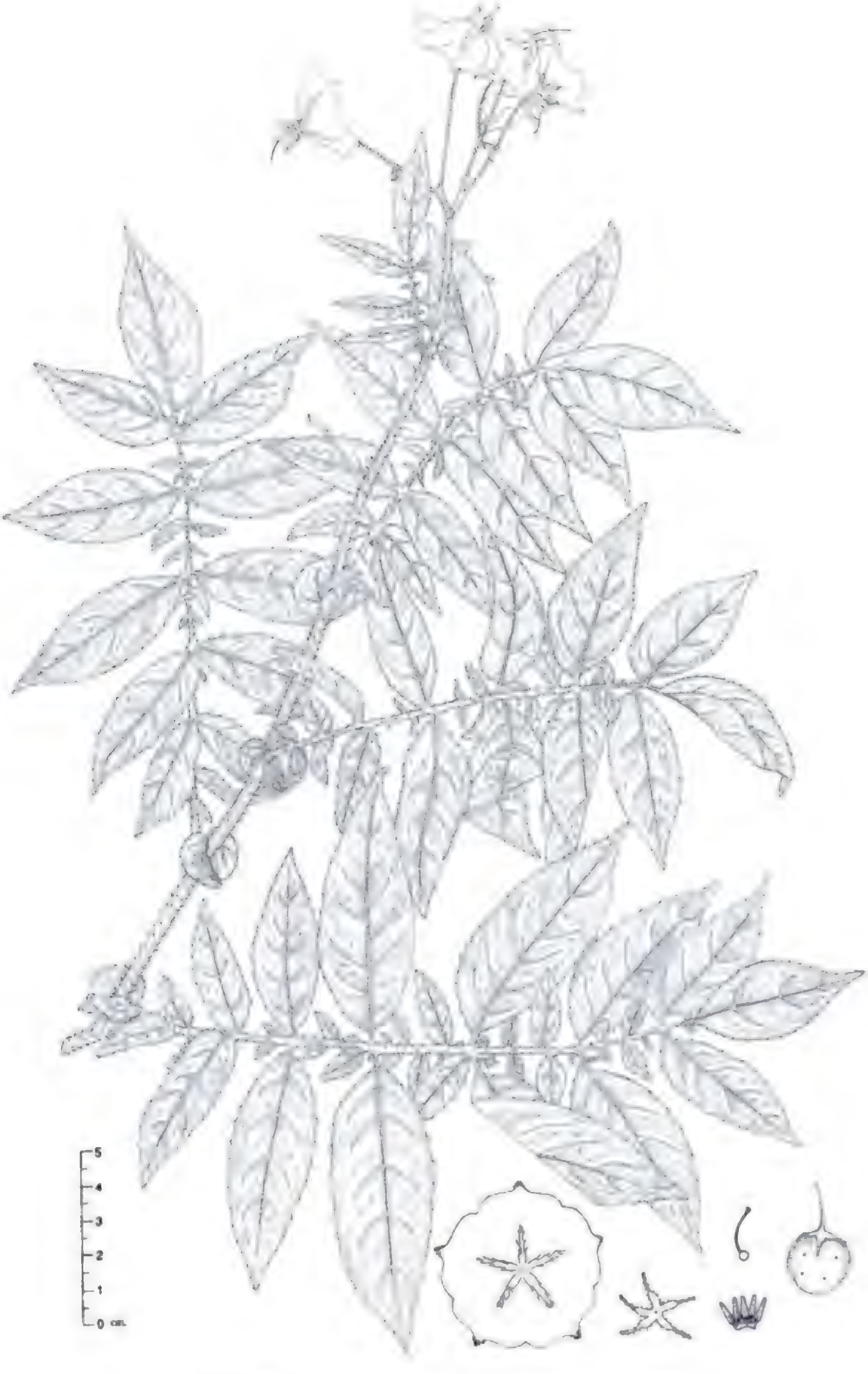


Figure 413. *Solanum wittmackii* (*Ochoa 7418*)

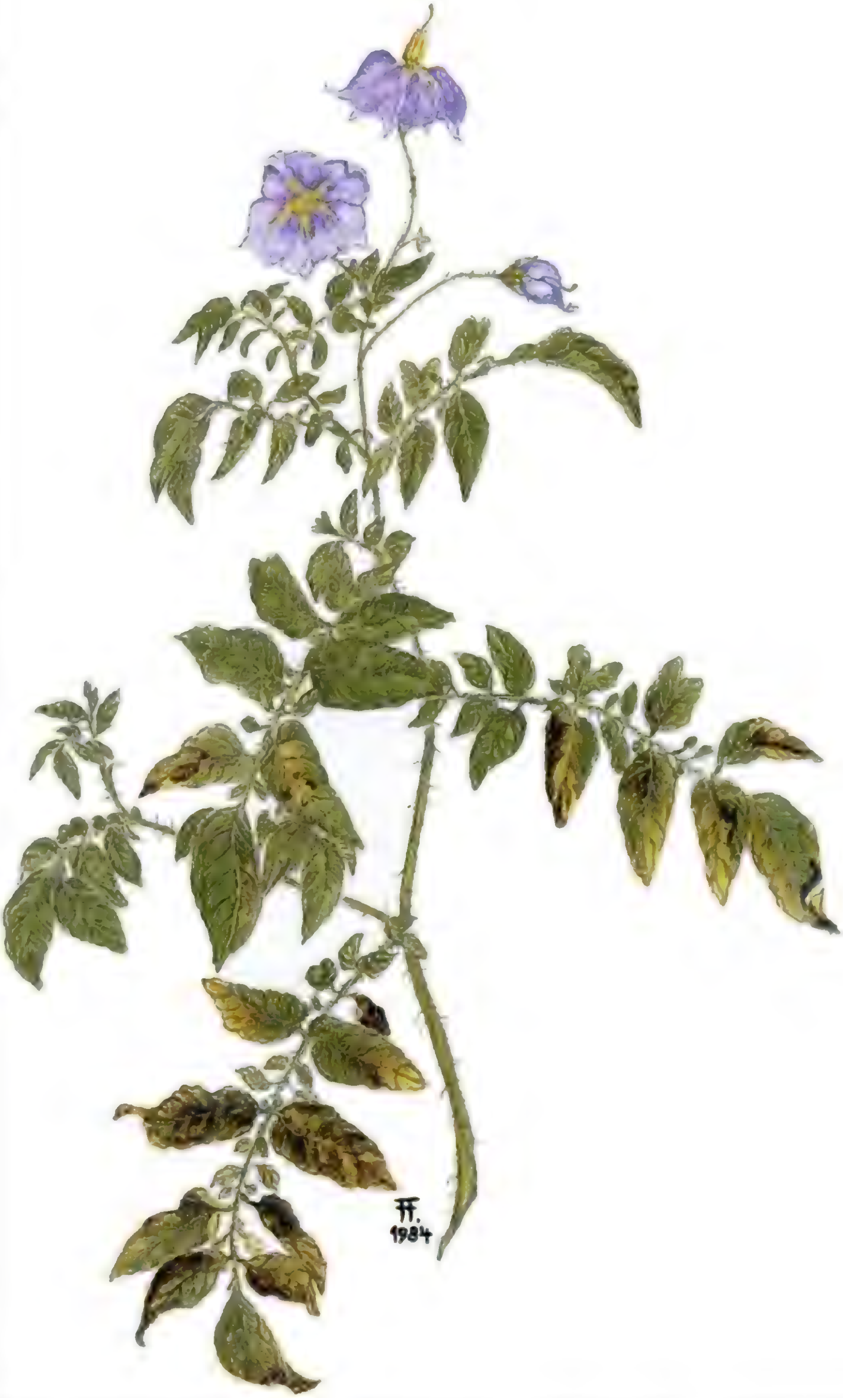


Plate XXXVI. *Solanum wittmackii* Bitt.

(-4.5) cm in dia., lilac, rarely purple or light violet, acumens very short, the margins puberulent. Staminal column subcylindrical-conical, anthers lanceolate or linear-lanceolate, 7.0-8.0 mm long by 1.8 mm wide, light yellow with a conspicuous dorsal suture and a cordate base; filaments 1-2 mm long, glabrous, white-hyalinous or slightly pigmented. Style curved or occasionally recurved near apex, 12-13 mm long, exerted 4.5-5.0 mm, shortly papillose below center; stigma slightly enlarged at the apex of the style, strongly cleft nearly bifid. Fruit globose, light green, 1.5-2.0 cm in dia. Chromosome Number: 2n=24. EBN=1.

Local Names: *Papa de Gentil* (in the *sierra*) or *Papita de San Juan* (the latter alluding possibly to the *fiesta* of San Juan that is traditionally celebrated towards the end of June in the coastal locality of Pampa de Amancaes).

Type: PERU. Department and Province of Lima, Lomas de Amancaes, among rocks, July 1833, *A. Mathews 847* p.p. (BM, CGE, E, GH, GL, K)

From the standpoint of the typification of this species, it is important to recognize that there exists two collections by Andrew Mathews that were given the same field numbers. One set of specimens, *Mathews 847*, which was collected in the Lomas de Amancaes, was seen by Bitter at the time he drew up his original diagnosis of this species. The various sheets of this collection are widely distributed throughout the herbaria of Europe. The other collection, also designated as *Mathews 847*, represents the species *S. chomatophilum* in the opinion of the present author. As previously pointed out in this text (see under the taxonomic

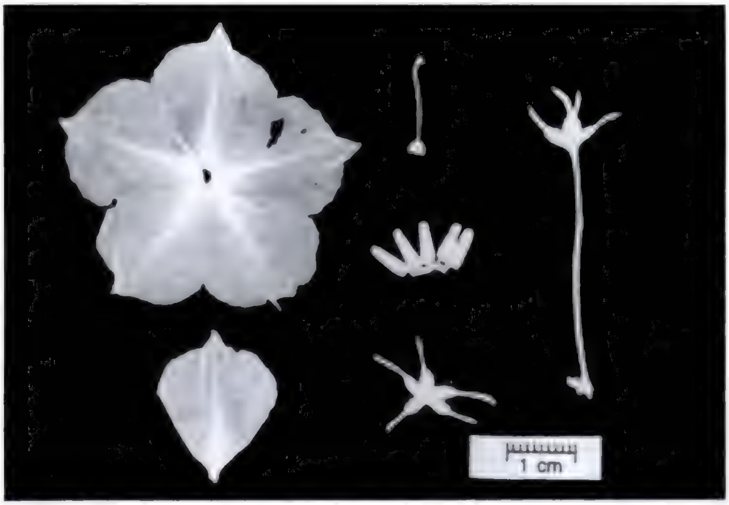


Figure 414. Floral dissection of *Solanum wittmackii* (*Ochoa 11312*), from a specimen collected at Zárate.

treatment of *S. chomatophilum*), Mathew collected his plants between the years 1834 and 1840, but failed to indicate the precise geographic location on his labels. This collection is today housed in the Gray Herbarium of the U.S.A.

Also of interest is the fact that this species was used in certain potato improvement trials that were conducted toward the beginning of the twentieth century by Nicolás Esposto and Ch. Deunomostier at the old School of Agriculture and Veterinary Science at Santa Beatriz, Lima (Deunomostier: Dir. De Fomento, Lima, 9(10):1-15, 1911 and 4:10-13, 1913). These selection trials were based on some tubers of a wild species that were collected by Esposto in 1909 at the Lomas de Pasamayo, north of Lima, that unfortunately were determined as *S. immite*, a species that had been previously described by Dunal in 1852. From the several photogravures that accompany Deunomostier's article, it can be clearly seen that the species involved was not *S. immite* but *S. wittmackii*, a species first described by Bitter in 1913, and thus this species could not have been known to Esposto in the year of his collection. Lastly, with respect to the selection trials that were conducted by Esposto and Deunomostier, it is hard to see whether these could have ever led to the development of a successful commercial potato variety, based as they were upon only a single wild species, *S. wittmackii*.

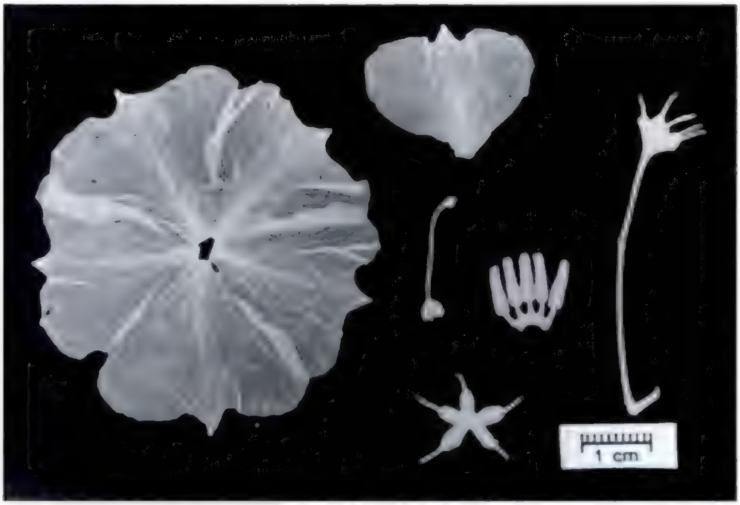


Figure 415. Floral dissection of *Solanum wittmackii* (*Ochoa 10983*), from a specimen collected at Zárate.

Affinities

This species is not closely related to any other wild Peruvian species of potato. Aside from some very distinctive floral details, *S. wittmackii* appears to be unique in having strongly divided leaves that are covered with a dense indumentum of long simple hairs which are intermixed with tetralobular glandular hairs. The latter impart a distinctive aroma to this species.

Habitat and Distribution

For many decades, the type locality of *S. wittmackii*, Amancaes (near Lima), has been the favorite spot of botanists interested in the collection of *loma* plants. The present author, along with others, has had in the past ample opportunity to observe this wild potato species growing in and among the large colonies of *Amancae* (=*Hymenocallis amancae*, a bulbiferous plant of the family Amaryllidaceae) that formerly grew abundantly at this site. Unfortunately, this unique ecological niche has disappeared forever as a result of the invasion of the site by a large group of settlers who founded a village some 15 years ago called "Pueblo Jóven de Amancaes." Thus, the habitat for *S. wittmackii* at Amancaes no longer exists, which is equally true for the type locality of *S. medians*, which neighbors Amancaes. The extent of the loss of habitat at this site is well illustrated by the photographs shown in Figs. 425 and 426, which depicts the locality of Amancaes before and after the advent of human settlement.

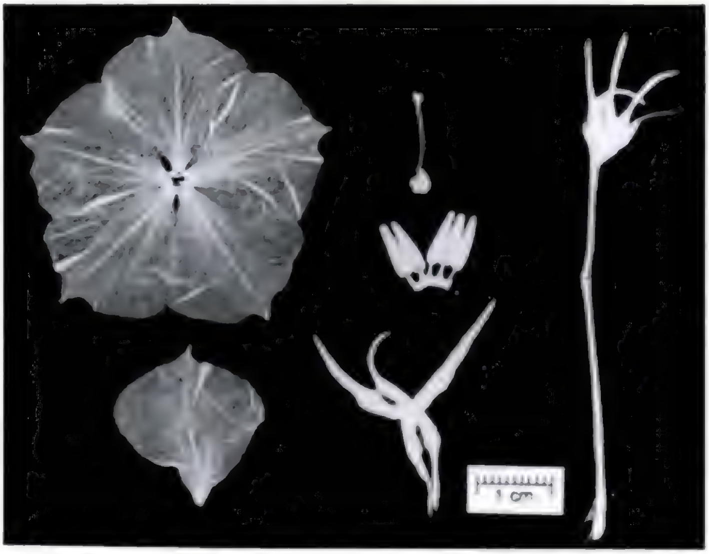


Figure 416. Floral dissection of *Solanum wittmackii* (*Ochoa 13215*).

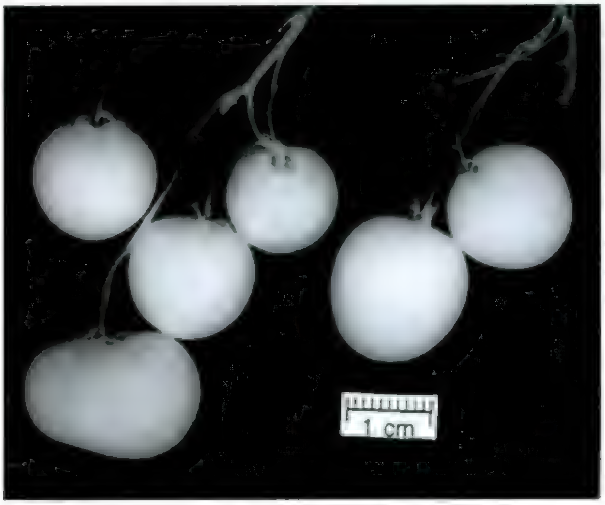


Figure 417. Fruits of *Solanum wittmackii* (*Ochoa 13271*).

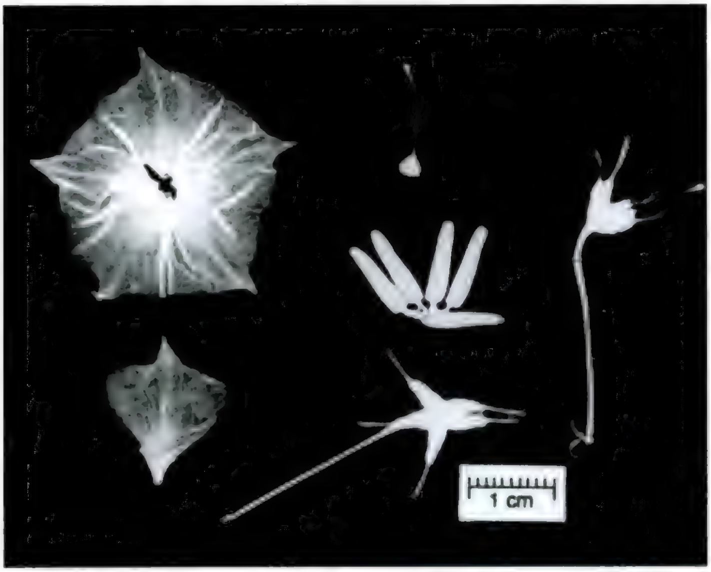


Figure 418. Floral dissection of a natural hybrid of *Solanum wittmackii* × *S. multiinterruptum* (*Ochoa 13265*).

material

With regard to the distribution of *S. wittmackii*, most authorities were formerly of the opinion that this species grew only in the *lomas* of Amancaes and the low (300-600 m alt.) neighboring hills or *colinas* of Lima, such as occur in the vicinity of San Gerónimo and Zárate. However, in more recent years the author has discovered that this species grows at a number of more inland locations in the Department of Lima, these situated along the mountain ranges on the western side of the Andes at elevations ranging from 2000 to 3400 m. Thus, aside from the immediate area of Lima, this species is today known from the Provinces of Cajatambo, Canta, Chancay, Huaral and Huarochirí.

According to an early report by the French explorer Edward André, who visited Peru in 1876 (*cf.* Baker 1884), there is also a possibility that *S. wittmackii* may inhabit the Island of San Lorenzo, which is situated a short distance from shore near the port city of Callao. André, at least, reports seeing a wild potato species growing profusely at both Amancaes and at the above mentioned island location. However, André did not collect any specimens of this plant, and no others are known to exist today in the world's herbaria.

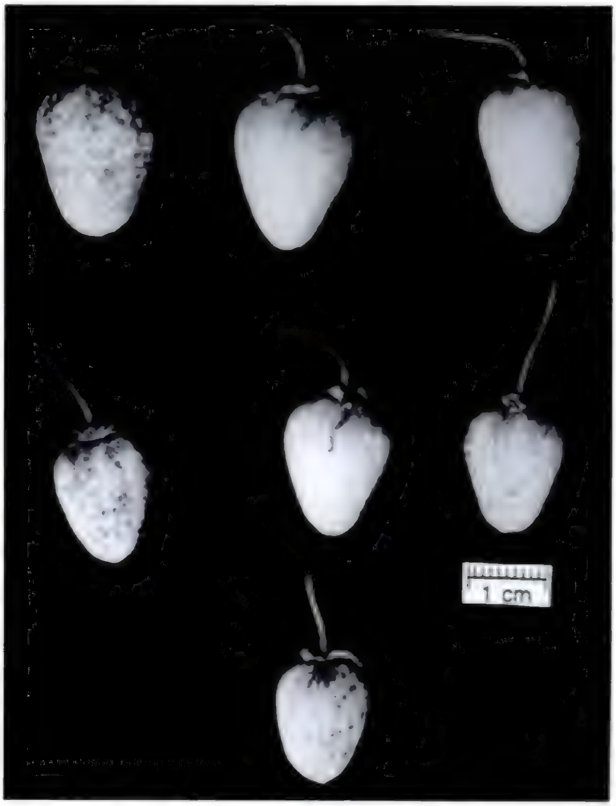


Figure 419. Fruits of a natural hybrid of *Solanum wittmackii* × *S. multiinterruptum* (*Ochoa* 10766).

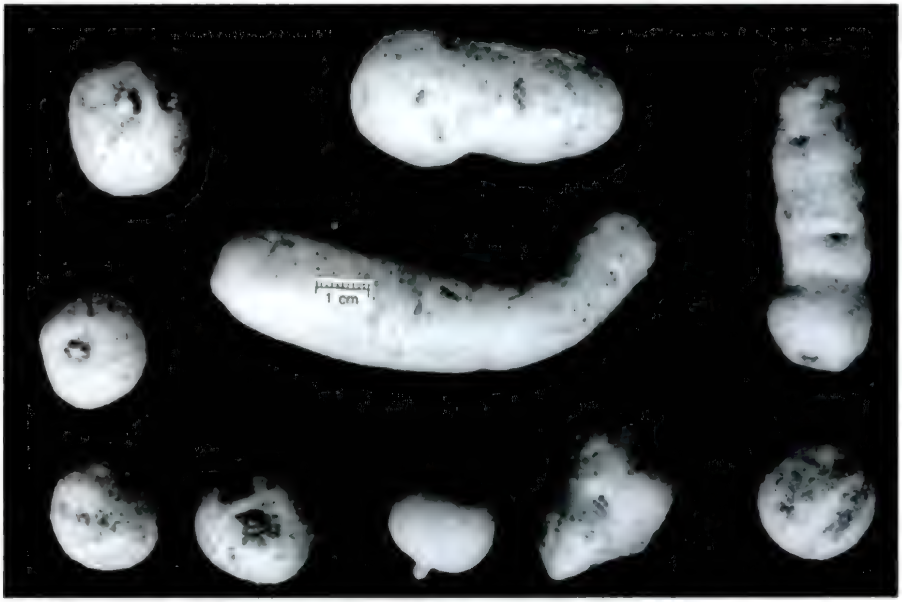


Figure 420. Tubers of *Solanum wittmackii* (*Ochoa 14674*), collected at Lutmacuta, 3000 m alt., west of Naván, Cajatambo, Lima.

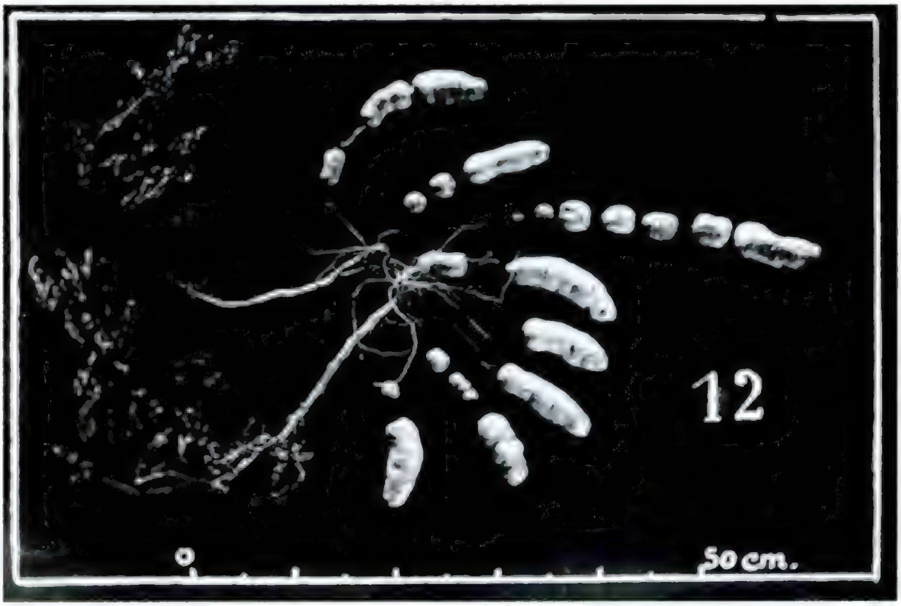


Figure 421. Tuberization of *Solanum wittmackii*. Photo: Dunomostier and Esposito, 1911, as *S. immite*.

A similar report of a wild potato species that grew on the Island of San Lorenzo was made by Nicolás Esposto in the early part of the twentieth century (*cf.* Deunomostier: Bol. Dir. De Fomento, Lima 9(9):36-41, 1911). In this case, Esposto's species was identified as "*Solanum tuberosum*" and described as "A species indisputably endemic, common in all cases to the arid mountains in the vicinity of Lima; essentially seasonally moist and allophytic." Most likely, this refers to the species which Bitter (1913) later described as *S. wittmackii*.

Finally, with regard to what we know today about the habitat preferences of *S. wittmackii*, it should be noted that this species grows preferentially in sandy-clay or gravelly soils, as well as on rocky slopes. It is associated with a scant *loma* flora of grasses and composites, which, upon occasion, also includes such other tuber-bearing species as *S. medians*, *S. multiinterruptum*, *S. cantense* and/or *S. hypacrarthrum*.

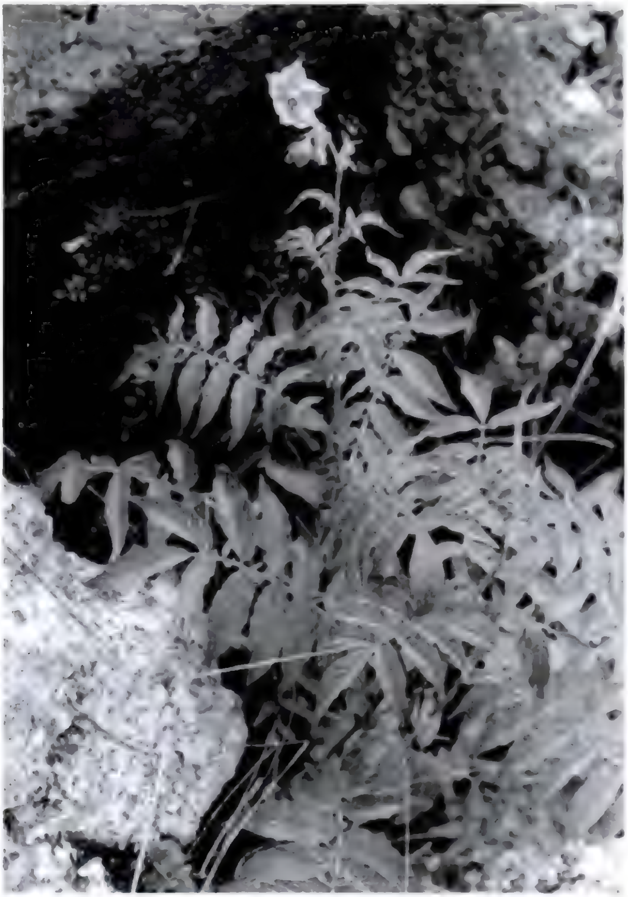


Figure 422. *Solanum wittmackii* in its natural habitat, *lomas* along the coast of central Peru, August 1979.

Specimens Examined

Department Lima

Province Cajatambo: District of Naván, about 5 km west of Cajatambo, 3200 m alt., among stones, associated with cacti and herbaceous composites, in full flower, flowers lilac, 8 April 1985, *C. Ochoa and A. Salas 12501* (CIP, MOL, OCH). Lucmacuta, 3000 m alt., on rocky hillsides, in full fruit, 12-18 April 1982, *C. Ochoa 14674*, 2n=24 (CIP, OCH).

Province Canta: Cuesta de Puruchuco, 2750 m alt., in a moist hollow in clay subsoil, lateritic. April 1950, *C. Ochoa s.n.* (OCH). Highlands of Arahuay, 3400 m alt., abundant, growing near *S. medians*, on steep hillsides among trees and large rocks, flowers pale violet, 1 May 1976, *C. Ochoa 11029*, 2n=24 (OCH). Between San José and Cuesta de Huamantanga, 2900 m alt., on rocky hillsides, scarce, 11 March 1977, *C. Ochoa 11309* (CIP, OCH). Heading up from Antura, via the route from Huascamayo, towards the ruin complex of Huarhuaymarca, 3000-3300 m alt., growing near *S. medians, S. multiinterruptum* and some few plants of *S. hypacrarthrum* amid herbaceous and shrubby vegetation, plant very pilose with 2-3 berries per inflorescence, 6 April 1979, *C. Ochoa 13258*, 2n=24 (CIP, GH, MO, MOL, OCH, US). Arahuay, 2900-3100 m alt., on inaccessible hillsides, among trees, plants 1.0-1.20 m tall, flowers purple, berries ovoid, tubers elongated, 28 May 1974, *G. Vilcapoma: 207-1* (OCH); *207-2* Arahuay, Pallashcushca (CIP) and *207-3*, Arahuay (CIP, OCH). Viscas, 2700 m alt., May 1974, *G. Vilcapoma 226* (CIP, OCH). Arahuay, Cerro Tununo, 2610 m alt., on rocky hillsides, flowers lilac, n.v. *Papa de Gentil*, 4 April 1975, *G. Vilcapoma s.n.* (OCH). Puruchuco, 2350 m alt., road toward Apan, flowers violet, 2 April 1994, *R. Moreyra and G. Vilcapoma 3048* (MOL, OCH).

Province Chancay: In the *loma* of Pasamayo, July 1913, *N. Esposto s.n.* (MOL). Cerro de Chancay, July 1913, *N. Esposto 57* (K).

Province Huaral: Tambo, 2200 m alt., between Huayapampa and Acos, right bank of the Chancay River, in forests of *Schinus molle* and among large boulders, tubers moniliform, round or long subcylindrical, abundant colonies, more than 200 plants, only one with berries, growing near *S. cantense* and grasses, February 1982, *C. Ochoa 14626* (CIP, F, MOL, NY, OCH), *14687*, 2n=24 (CIP, OCH, MOL, plants grown at Huancayo).

Province Huarochirí: Between Opico and Huinco, 2900 m alt., 3 miles past Opico on the Huinco highway, in very rocky ground, 29 February 1972, *Z. Huamán, H. Ross, F. de la Puente and J. Bryan 293-A* (CIP, MOL, OCH). Left bank of the Santa Eulalia River, 2500-2600 m alt., amid stones and subxerophytic habitat, March 1975, *C. Ochoa 7408* (OCH). Near the forests or at the margins of the forests of Zárate, 2650-3100 m alt., March 1975, *C. Ochoa 7415* (CIP, MO, MOL, OCH), *7418* (CIP, MO, MOL, OCH, US), *10982* (CIP, MOL, OCH) and *10983* (CIP, OCH plants grown at La Molina in 1976). Gigantón, 2900 m alt., near the forests of Zárate, berries globose to pyriform, n.v. *Papa del Gentil*, growing near *S. medians*, 16 March 1977, *C. Ochoa 11310* (OCH) (CIP, MO, MOL, OCH, plants grown at Huancayo) and *11312* (CIP, MOL, OCH). Near Huinco, 2200 m alt., Santa Eulalia Valley, on rocky hillsides, 21 February 1975, *C. Ochoa 11877*, 2n=24 (CIP, MOL, OCH). Near Agropica, 2520 m alt., Santa Eulalia Valley, 21 February 1978, *C. Ochoa 11886*, 2n=24 (CIP, MO, MOL, OCH, US). Highlands of Seque, 3000 m alt., near Huinco, above the Santa

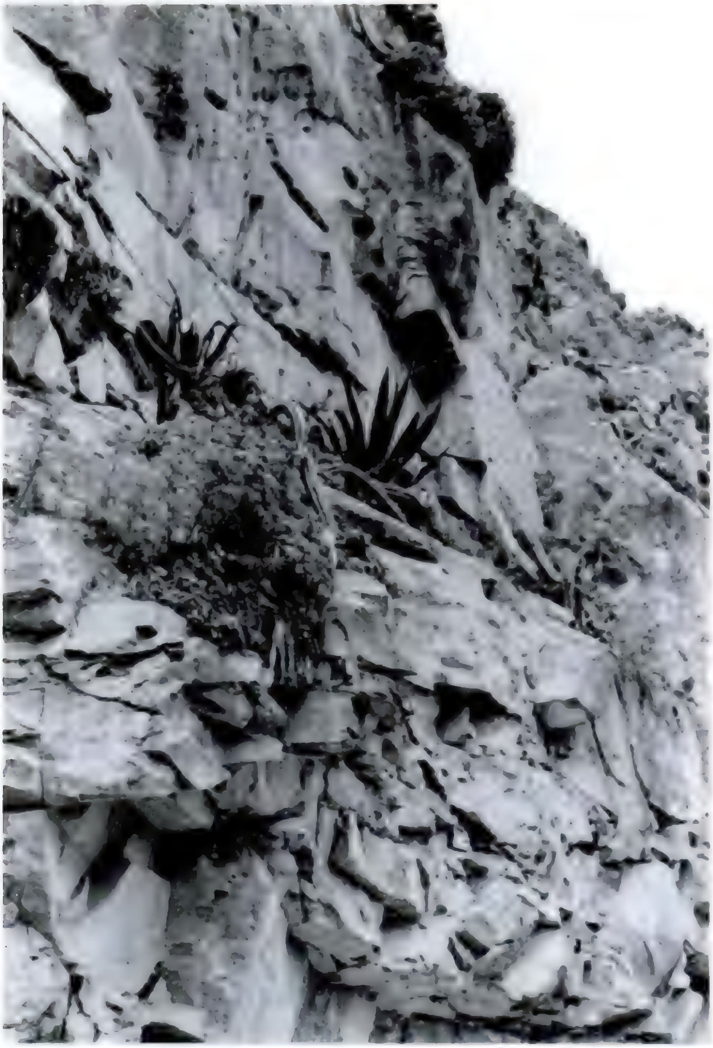


Figure 423. *Solanum wittmackii*, in its natural habitat, between Langa and Matarachi, 2000 m alt., Huarochirí, Lima, March 1982. Photo: C. Ochoa.

Eulalia Valley, 16 February 1979, *C. Ochoa 13184,* 2n=24 (CIP, MOL, OCH). Vicinity of San Pedro de Casta, 3000 m alt., 19 February 1979, *C. Ochoa 13215,* 2n=24 (CIP, MO, OCH). Near Autisha, 2450 m alt., Santa Eulalia Valley, scarce, berries globose to ovoid, light green with abundant seed, 11 April 1979, *C. Ochoa 13267,* 2n=24 (CIP, OCH). Above Autisha, 2675 m alt., beautiful large colony of plants in full flower, plants glandular with many long simple hairs and short tetralobular glandular hairs, corolla violet or dark lilac, large up to 6 cm in dia., very showy, 11 April 1979, *C. Ochoa 13271,* 2n=24 (CIP, MO, MOL, OCH). Quebrada Honda, 3300 m alt., between Collata and San Mateo, scarce, among stones, grasses and shrubs, berries globose to pyriform, 7 May 1982, *C. Ochoa 14742* (OCH, plants grown at Huancayo). District Santiago de Tuna, north of Lucmani, facing the forests of Zárate, 3000-3200 m alt., growing near *S. medians,* 17 March 1983, *C. Ochoa and A. Salas: 15101,* 2n=24 (CIP, OCH), *15102,* 2n=24 (F, NY, OCH).

Province Lima: Amancaes near Lima, about 30 m alt., western base of mountains, 21 July 1876, *E. André 4114* (K, two sheets, type of *S. wittmackii* var. *glauciviride*). Lomas de Amancaes facing Lima, 250 m alt., winter vegetation herbaceous, n.v. "*Papita de San Juan,*" 2 September 1956, *E. Cerrate 2742* (OCH, USM). Lomas de Amancaes, near Lima, 200-250 m alt., in rocky foothills, flowers lilac, n.v. "*Papita de San Juán,*" 21 August 1949, *R. Ferreyra 6264* (LL, MOL, OCH, US, USM). Lomas de Amancaes, facing Lima 300-350 m alt.,

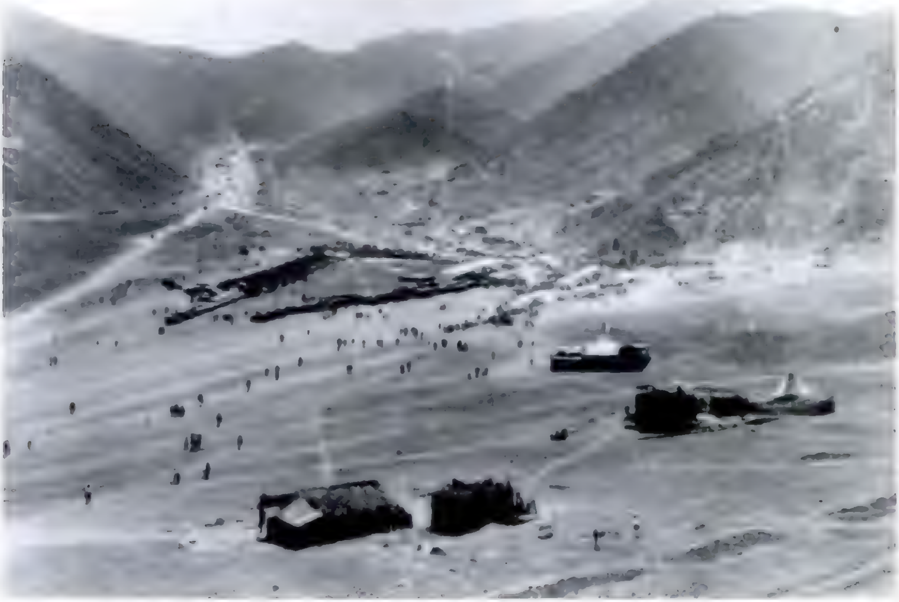


Figure 424. Amancaes, Lima, 1928. Photo: Courtesy of the Municipality of Lima.

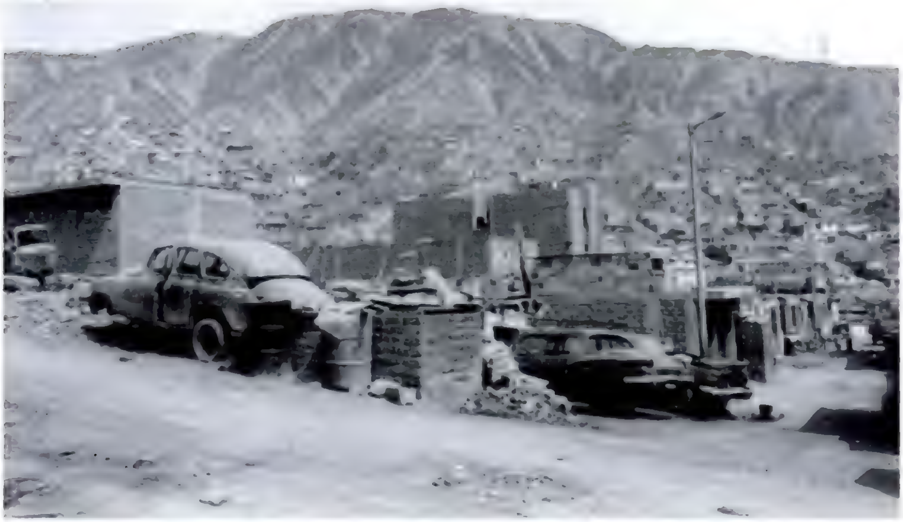


Figure 425. Amancaes, Lima, July 1995. Photo: C. Ochoa.

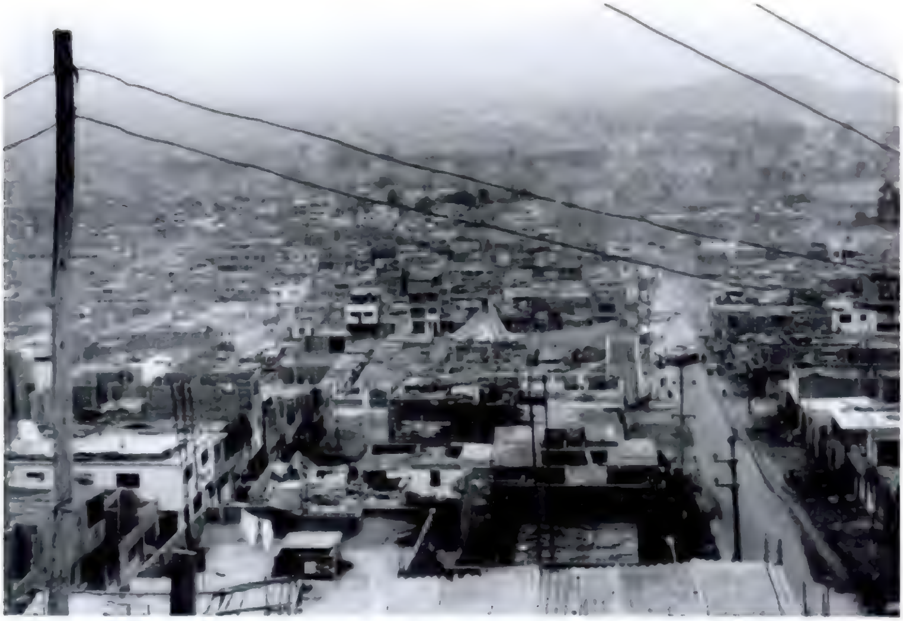


Figure 426. Human degradation of the habitat, Amancaes, Lima, type locality of *Solanum wittmackii*. Photo: C. Ochoa, January 1988.

among stones, flowers violet, n.v. *Papita de San Juan*, 1 October 1960, *R. Ferreyra* and *P. Hjerting 14148* (LL, OCH, USM). San Gerónimo, Lomas de Amancaes [near Lima], about 155-180 m alt., on rock slide, Flowers purple, 19 September 1923, *J. Francis MacBride 5890* (F). Amancaes, *Martinet 332* (*984*) (P, received in 27 December 1878, possibly of the same origin as *Martinet 514*), and *Martinet 514* (P). Lomas de Amancaes, amongst rocks, July 1833, *A. Mathews 847 p.p.* (BN, CGE.E. GH, GL, K, OXF, TC, type collection of *S. wittmackii*). Cerro de San Gerónimo, Lomas de Amancaes, 300 m alt., near Lima, abundant, among stones and rocks, plants pilose more than 1 m tall with stems bored by the larva of the "tomato grub" (=*Phyrdenus divergens*), flowers deep violet up to 4 cm in dia., tubers long subcylindrical, whitish-yellow, 4-5 cm long, 12 August 1948, *C. Ochoa 590* (OCH, US). Lomas de Amancaes, near Lima, 250 m alt., among rocks, 26 August 1952, *C. Ochoa 1805* (GH, OCH-three sheets, US). Amancaes, near Lima, 300 m alt., July 1943, *J. Soukup 2058* (OCH, two sheets). Amancaes, 300-500 m alt., 6 September 1950, *C. Vargas C. 9645* (CUZ, LL 2 sheets, MO, OCH). Lomas near Chorrillos [Lima], only tubers collected, 28 october 1932, *N.I. Vavilov & A. Weberbauer s.n.* (WIR=K-19, type collection of *S. vavilovii*, from plants grown at Ingra, near Leningrad in 1933, from the originally collected tubers). Lomas de Amancaes, ca. 300 m alt., flowers blue, growing among stones, 12 August 1953, *O. Velarde Nuñez 4063* (OCH). Mountains of Amancaes, near Lima, 250-300 m alt. September, 1910. *A. Weberbauer 5705* (F=two sheets, GOET=drawings of spec. ex Herb. Berlin and fragment of a specimen, GH-two sheets, NY, S, US, W).

Province Indefinite: Indefinite, *J. Soukup 1614* (F). Without exact locality or collector's name, from plants grown in 1946 at Edinburgh, Scotland, (CPC No. 1703, determined as *S. vavilovii*). Lima 1868-1871, Dr. *Barranca 208 p.p.* (W, mixed with *S. medians*).

Putative Natural Hybrids of *Solanum wittmackii* Bitt. × *S. multiinterruptum* Bitt.

In the valley or river basin of Sta. Eulalia, between 2300-3200 m alt., there occur various wild tuber-bearing species of potato, such as *S. hypacrarthrum*, *S. medians*, *S. multiinterruptum* and *S. wittmackii*. Within this river basin, the author has identified certain natural hybrids that appear to be a cross between *S. wittmackii* and *S. multiinterruptum*. These hybrids, which are generally quite close in appearance to *S. wittmackii*, are robust and very pilose plants, up to 1 m or more tall, having very divided leaves but with fewer lateral leaflets (5-6 pairs) than is normal for the species. Also, the leaves are shorter and broader than the typical species, and have broadly elliptic-lanceolate leaflets with pointed or acuminate tips and rounded bases which are borne on long petiolules, sustaining usually 1 to several interjected leaflets. The lilac flowers of the hybrids are rotate or more rarely rotate pentagonal. The chief difference with respect to *S. wittmackii* lies in the form and color of the berries, which are long-ovate to long-conical, dark gray-green and densely spotted with white dots, but not verrucose (compare with berries of *S. multiinterruptum*, illustrated in Fig. 360). However, in specimen No. *11636*, the berries are ovoid to globose and are uniformly light green.

Department Lima, Province Huarochirí: Between Huinco and Huachupampa, 2800 m alt., Santa Eulalia Valley, plants vigorous very pilose resembling *S. wittmackii* but berries long-ovate, nearly conical, grayish-green, densely spotted with white dots but not verrucose, up to 20 mm long, April 1975, *C. Ochoa 10766* (CIP, OCH, plants grown at Huancayo). High part of the Quebrada de Santa Eulalia, on dry rocky hillsides, berries long-conical like a bird egg, 5 April 1975, without collector or number (CIP, OCH). San Pedro de Casta, 3000 m alt., berries globose to ovoid, uniformly light green, growing near *S. medians*, May 1977, *C. Ochoa* and *A. Salas 11636*, 2n=24 (OCH, plants propagated at Huancayo from original cuttings). Near and above Cajas, 3182 m alt., berries long-conical, grayish-green with densely white dotted, May 1977, *C. Ochoa and A. Salas 11639*, 2n=24 (CIP, OCH). Autisha, 2325 m alt., heading up from Santa Eulalia to Hinco and Seque, Santa Eulalia Valley, growing with *S. medians*, abundant, berries long-conical, grayish-green and densely white dotted but not verrucose, only 7-8 seeds per baya, 11 April 1979, *C. Ochoa 13265*, 2=24 (CIP, MO, MOL, OCH), identical to *OCH-10766*.

Breeding Potential

The results of crosses of *S. wittmackii* (2n=24 and EBN=1) with diploid species (2n=24) of EBN=1 and EBN=2 are given in Table 104, while the materials used in these experiments are shown in Table 105.

Reciprocal crosses involving *S. wittmackii* and two other EBN=1 species, *S. hypacrarthrum* and *S. mochiquense*, were rather easily accomplished. However, with the exception of two crosses made with EBN=2 species, *S. medians* and *S. multiinterruptum*, all remaining attempts at crossing this species with plants having an EBN value of 2 resulted in failure.

Table 104. Fertility of *Solanum wittmackii* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
24	1	PIURANA	× *S. hypacrarthrum*	14(24)	4(16)	150(43)
24	1	TUBEROSA	× *S. mochiquense*	64(50)	35(26)	48(102)
24	2	CONICIBACCATA	× *S. chomatophilum*	14(6)	2(0)	0(0)
24	2	MEGISTACROLOBA	× *S. raphanifolium*	6(9)	0(0)	0(0)
24	2	PIURANA	× *S. cantense*	6(15)	0(0)	0(0)
24	2	TUBEROSA	× *S. bukasovii*	5	3	0
			× *S. goniocalyx*	6(11)	1(2)	0(0)
			× *S. medians*	32(46)	3(17)	25(35)
			× *S. multiinterruptum*	23(18)	18(12)	77(93)
			× *S. phureja*	19	9	0
			× *S. tacnaense*	9(12)	0(0)	0(0)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 105. Collections (OCH) used in crossability studies of *Solanum wittmackii.*

CONICIBACCATA
S. chomatophilum 11061

MEGISTACROLOBA
S. raphanifolium 15628

PIURANA
S. cantense 14692, 14828
S. hypacrarthrum 11692, 13272

TUBEROSA
S. bukasovii 14333
S. goniocalyx 00001, 14502
S. medians-2x 11259, 12046, 12047, 13140, 13185, 13268
S. mochiquense 14820, 14870
S. multiinterruptum 11693, 13259, 14674
S. phureja Bulk phu
S. tacnaense 11609
S. wittmackii 10982, 10983, 11029, 11310, 11312, 11639, 11876, 11877, 13154, 13184, 13215, 13258, 13271, 14626, 14674, 14687

SERIES YUNGASENSA

YUNGASENSA, Corr., in *The Potato and Its Wild Relatives*, 220, 1962, and J.G. Hawkes in *The Potato: Evolution, Biodiversity and Genetic Resources*, 92-97, 1990.

Series Glabrescentia Buk., in Buk. et Kameraz, *Bases of Potato Breeding*, 19, 1959, *nom. non rite publicatum*.
Series Tarijensa Corr., in *The Potato and Its Wild Relatives*, 233, 1962.

Plant lax-erect to erect-ascending, stoloniferous and tuber-bearing. Leaves imparipinnate with or without interjected leaflets; leaflets elliptic-lanceolate or lanceolate, with slightly pointed, pointed or acuminate tips. Pedicels articulated near mid-center, rarely high above center or near base of calyx. Calyx usually small, the lobes generally apiculate or less frequently acuminate. Corolla usually deeply stellate, white to creamy-white or yellowish, the lobes generally ovate-triangular-lanceolate, two or more times long than the broad and strongly reflexed. Fruit round or somewhat conical, uniformly light green or marked with small white dots. Chromosome Numbers: 2n=24 and 2n=36.

A reexamination of the material of this series has convinced the author that it should be retained as valid subgroup of Section Petota. Plants of this series were previously treated as members of the Series Comersoniana by Hawkes (1963 and 1989) and Ochoa (1990).

Affinities

The plants of this series are related to Comersoniana through the species *S. comersonii* and *S. calvescens*.

Distribution

The series Yungasensa, as represented by its single species S. *yungasense*, extends from the southernmost part of the country through Bolivia, northwest Argentina, Paraguay and Uruguay to southern Brazil, generally at altitudes between 1000 and 2400 m. Other members of this series, such as *S. tarijense*, are known from altitudes as high as 3000 m.

Bolivia has the largest number of species of this series, including *S. chacoense*, *S. litusinum*, *S. tarijense* and *S. yungasense*; whereas Argentina and Brazil share but a single species, *S. muelleri*. Two species that were treated by Hawkes (1990) as members of Series Yungasensa, *S. flavoviridens* (2n=36) of northwest Bolivia and *S. huancabambense* (2n=24) of extreme northern Peru, are treated in this work as members of Series Tuberosa.

Little or nothing is known about the potential of *S. yungasense* for use in potato improvement programs. Being a species that is adapted to conditions of high temperatures and rainfall, and being one that is also seldom attacked by sucking and chewing insects, makes this plant an ideal candidate for genetic studies aimed at the development of new commercial varieties for the humid tropics. It can be crossed at both levels of ploidy (2n=24 and 2n=36), and is cross-compatible with cultivated diploids, *S. goniocalyx* and *S. phureja*, and tetraploid *S. tuberosum*.

90. ***Solanum yungasense*** Hawkes, Ann. and Mag. Nat. Hist., Ser. 12; 7:697, Fig. 5-6, 1954. Figs. 427-430; Map 30.

Plant erect-decumbent or laxly erect, 120-150(-200) cm tall, glabrous or subglabrous. Stem light green, simple or branched, sparsely pubescent, 5-17 mm in dia. at base, wings conspicuous, strongly sinuous at base, straight at the midpoint and in the upper one-third of the stem, 1-3 mm wide; internodes (4-)7-10 (-12) cm long. Stolons 1-2 m long and 2-3(-5) mm in dia., white and fleshy; tubers round to ovoid or elongate subcylindrical, 3-4 cm long, pure white or pale brownish-violet towards the apex and abundantly lenticulate, buds densely pubescent, white but tinged with brownish-lilac at base and apex, flesh white. Leaves light green, long and narrow, (10-)14-21(-35) cm long by (5-)6-12(-17) cm wide, very sparsely pubescent above with simple hairs intermixed with short glandular hairs and only a few hairs on the veins and veinlets below. Leaves imparipinnate, with 4-6 pairs of leaflets and 0-3 pairs of small interjected leaflets, sessile, ovate to orbicular. Terminal leaflets of nearly the same size or slightly larger than the adjacent lateral leaflets, (4.0-)5.5-7.5(-9.0) cm long by (1.5-)2.5-3.0 cm wide,

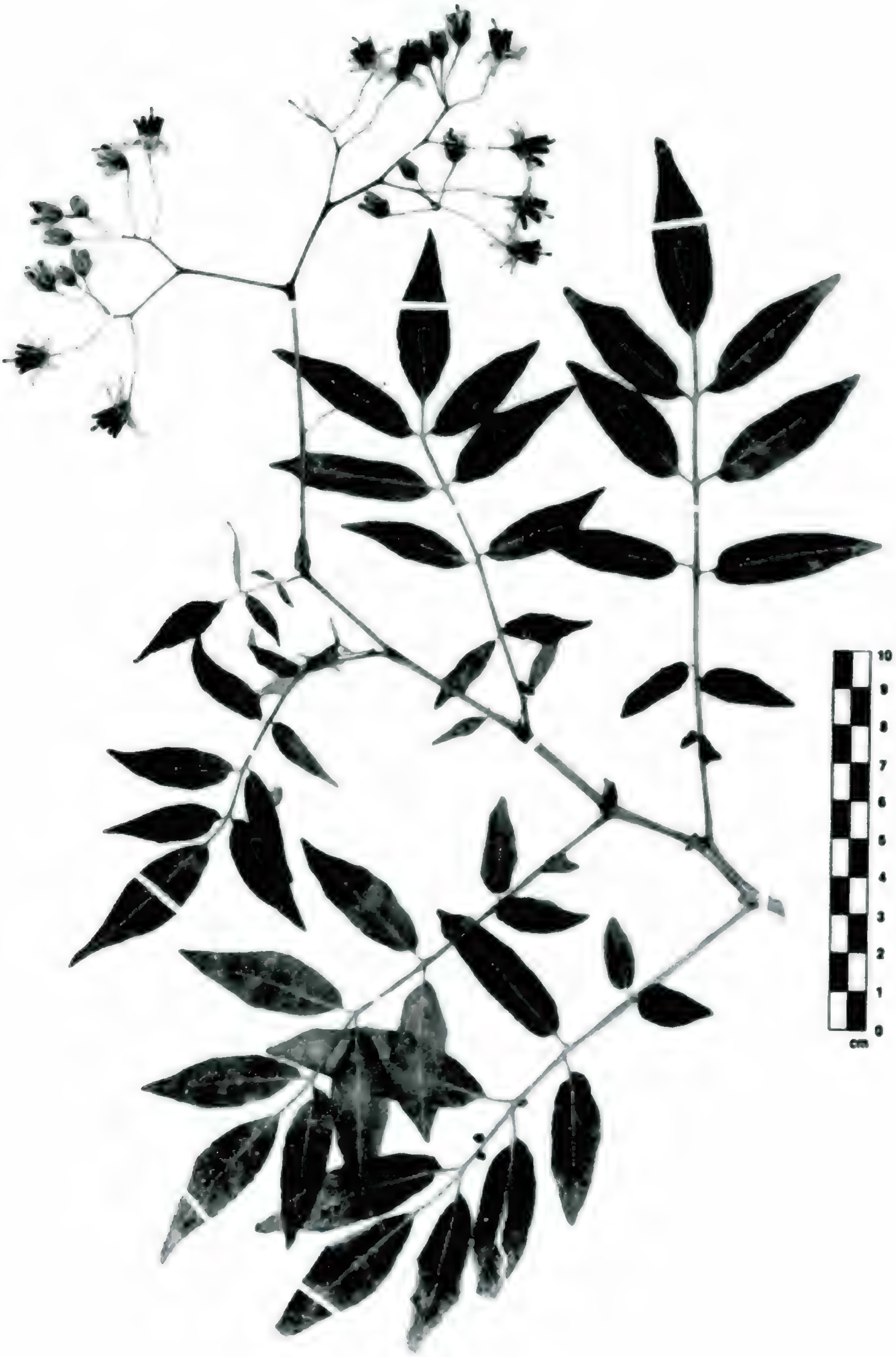


Figure 427. *Solanum yungasense*-3x (*Ochoa and Salas 14830*).

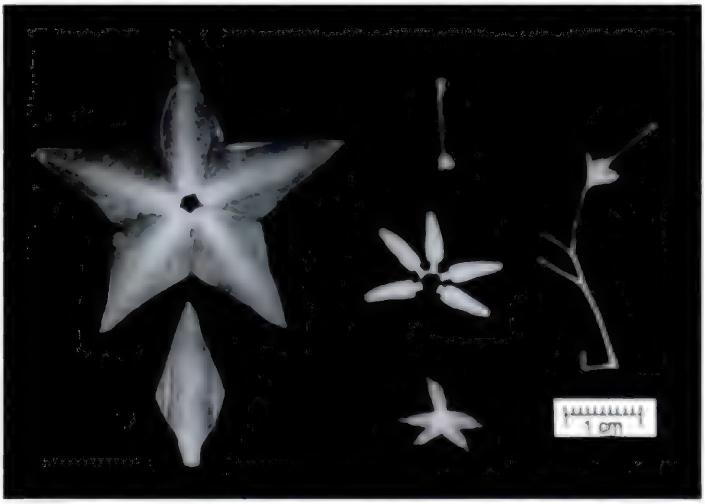


Figure 428. Floral dissection of *Solanum yungasense*-3x (*Ochoa and Salas 15029*), from a specimen collected at San Juan del Oro, Sandia, Puno.

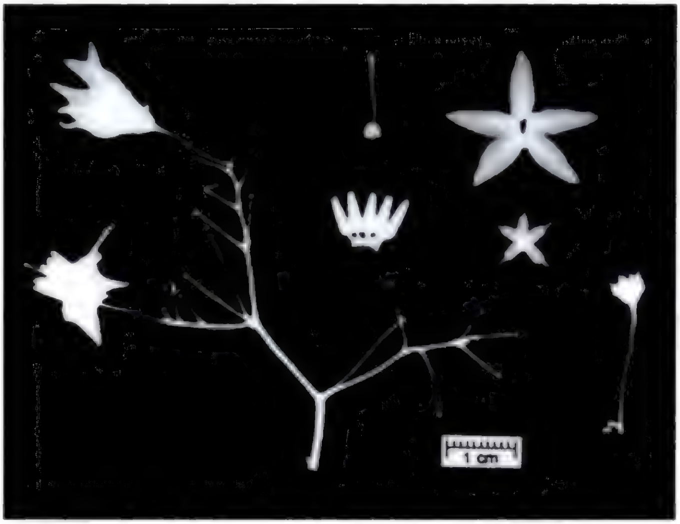


Figure 429. Floral dissection of *Solanum yungasense*-3x (*Ochoa and Salas 15029*).

narrowly ovate-lanceolate or elliptic-lanceolate, with acuminate tips and attenuate bases; lateral leaflets lanceolate or narrowly elliptic-lanceolate, with attenuate-acuminate tips and slightly attenuate to round or obliquely rounded bases, on petiolules 2-6 mm long. Pseudostipular leaves semi-elliptic, lunate or broadly falcate, to 1 cm long. Inflorescence cymose-paniculate to cymose, lax, usually very floriferous, 25-35-flowered. Peduncle (6-)10-15 cm long, slender, 1.5-2.5 mm in dia., forked or bifurcate, subglabrous as in the case of the pedicels; pedicels 15-20 mm long, articulated slightly above the midpoint or about 6-7(-8) mm below the base of the calyx. Calyx asymmetrical or symmetrical, small, 5.5 mm long, sparsely pilose and glandular; lobes short and broadly elliptical and rounded at the apex and abruptly narrowed to 1.5 mm long acumens. Corolla deeply stellate, 2.5-3.0 cm in dia., reflexed, creamy-white, with a yellow internal star and triangular-lanceolate lobes, 8-10(-12) mm long by 5-9 mm wide at base. Anthers forming a dolabriform column, light yellow, narrowly lanceolate, 5.5-6.0 mm long, base cordate; filaments 1.5-2.0 mm long, slender, glabrous. Style 9 mm long, sparsely papillose along the basal one-third of its length, exerted 2 mm; stigma capitate to subclaviform. Fruit round, light green, white dotted, not verrucose, 1.5 cm in dia. Chromosome Numbers: $2n=24$ and $2n=36$.

Type: BOLIVIA. Department La Paz, Province Nor Yungas, Milluhuaya, 1300 m alt., December 1917, *O. Buchtien 617* (holotype K, isotypes BM, C, GH, M, NY, S, US).

Although triploid forms of *S. yungasense* have not been reported by other authors, this writer has determined that these kinds are actually quite common in certain south Peruvian populations of this species. For example, three of the four plant collections of *S. yungasense* that were obtained by him in collecting expeditions to the Province of Sandia in the Department of Puno turned out to be triploid ($2n=36$), while only one was diploid ($2n=24$).

Affinities

This species is related to *S. chacoense* and some of its segregate forms (such as the plant described as "*S. arnezii*"). The two species are similar with regard to the light green color of the entire plant, the form of the leaves and leaflets, the size of calyx and the stellate shape and creamy-white color of the corolla.

Habitat and Distribution

In Bolivia, this species is restricted to the phytogeographical formation called *Yungas* (this situated largely in the Provinces of Nor Yungas and Sud Yungas, Department of La Paz, in northwest Bolivia; *cf.* Hawkes and Hjerting, 1989, p. 157). However, in Peru, this species occurs in the lowland tropical forest region of the Department of Puno in southeast Peru (Ochoa, 1990, p. 93). In the vicinity of San Juan del Oro, for example, which is situated in the Tambopata River Valley in the Province of Sandia, Puno, this species grows at elevations ranging from 1500 to 1800 m in large forests of *Inga*, as well as in and near fields of coffee, oranges, bananas and other tropical crops. Both diploid and triploid plants of *S. yungasense* occur at this location.

Specimens Examined

Department Puno

Province Sandia: Left bank of the Tambopata River, 1500 m alt., near San Juan del Oro, plants very young, without flowers or fruits, growing in forests of *Inga* and plantations of banana, oranges and sweet potatoes, 6 June 1982, *C. Ochoa and A. Salas 14830*, 2n=36 (CIP, OCH). Lower slopes of Cerro Botijana, 1500 m alt., facing San Juan del Oro, amid coffee and banana plants and trees of *pacae*, plants young, without flowers or fruits, a few tubers, 8 June 1982, *C. Ochoa and A. Salas 14842*, 2n=36 (CIP, OCH). Vicinity of San Juan del Oro, 1500 m alt., plants very mature and vigorous 1.50 m tall or more, stems broadly winged, flowers stellate and white, berries round, only tubers and cuttings were collected, 14 February 1983, *C. Ochoa and A. Salas 15029*, 2n=36 (CIP, MOL, OCH, USM).

Churiuma, 1800 m alt., about 2 km from Bertapata along the route from Marroncunca to Sandia, plants growing on the ground among tropical crops such as coffee, bananas, oranges, etc., 14 February 1983, *C. Ochoa and A. Salas 15041*, 2n=24 (CIP, OCH).

Breeding Potential

The results of crosses of *S. yungasense* (2n=24 and EBN=2) with diploid species of EBN=2, triploids (2n=36) of *S. yungasense* with diploids of EBN=1 and EBN=2 and tetraploids of EBN=4 are given in Table 106, while the materials used in these experiments are shown in Table 107.

Unilateral crosses of diploid *S. yungasense* with two other EBN=2 plants, *S. goniocalyx* (562-85) and *S. phureja* (15073), yielded an average of 50 seeds per berry for each species. Reciprocal crosses of triploid *S. yungasense* with *S. tuberosum* subsp. *andigena* (2n=48 and EBN=4) were also successful, but the average seed yield per berry was much lower. Moreover, as shown in Table 104, reciprocal crosses involving triploid *S. yungasense* and *S. sparsipilum* (2n=24 and EBN=2) were also successful. Surprisingly, this cross yielded a fair amount of seed when the triploid plant was used as both the staminate and the pistillate parent. However, in reciprocal crosses involving triploid *S. yungasense* and *S. neovavilovii* (2n=24 and EBN=2), seed was obtained only when the latter species was used as the staminate parent.

Table 106. Fertility of *Solanum yungasense* when used as a pistillate parent in selected crosses (the results of reciprocal crosses using this species as a staminate parent are indicated in parentheses). See note at end of systematics chapter for further explanation.

2n	EBN	Series	Species	FL	TB	SB
			Crosses Involving Diploid (2n=24) *S. yungasense*			
24	2	TUBEROSA	× *S. goniocalyx*	1	1	50
			× *S. phureja*	1	1	50
			Crosses Involving Triploid (2n=36) *S. yungasense*			
24	1	CIRCAEIFOLIA	× *S. circaeifolium*	33	9	0
			× *S. circaeifolium* var. *capsicibaccatum*	16	0	0
24	2	CONICIBACCATA	× *S. limbaniense*	16	3	0
			× *S. neovavilovii*	1(3)	1(0)	60(0)
24	2	CUNEOALATA	× *S. infundibuliforme*	9	3	0
24	2	MEGISTACROLOBUM	× *S. raphanifolium*	10	3	0
24	2	TUBEROSA	× *S. candolleanum*	7(4)	6(1)	0(0)
			× *S. microdontum* var. *montepuncoense*	4	0	0
			× *S. orophilum*	5	3	0
			× *S. sparsipilum*	9(4)	9(3)	56(33)
			× *S. vidaurrei*	13	8	0
48	4	TUBEROSA	× *S. tuberosum* subsp. *andigena*	16(20)	2(4)	5(23)

FL=total number flowers pollinated, TB=total number berries obtained, SB=average number seeds per berry.

Table 107. Collections (OCH) used in *Solanum yungasense* fertility studies.

CIRCAEIFOLIA
S. circaeifolium 11796, 11806
S. circaeifolium var. *capsicibaccatum* 11915

CONICIBACCATA
S. limbaniense 14288, 14290
S. neovavilovii 14962, 14993

CUNEOALATA
S. infundibuliforme 11977

MEGISTACROLOBA
S. raphanifolium 13775

TUBEROSA
S. candolleanum 11896, 14990
S. goniocalyx 562-85
S. microdontum var. *montepuncoense* 12025
S. orophilum. 13003
S. phureja 15073
S. sparsipilum 13588
S. tuberosum subsp. *andigena* 15032, 15033, 15039
S. vidaurrei 12003

YUNGASENSA
S. yungasense-2x 15041
S. yungasense-3x 14830, 14842, 15029

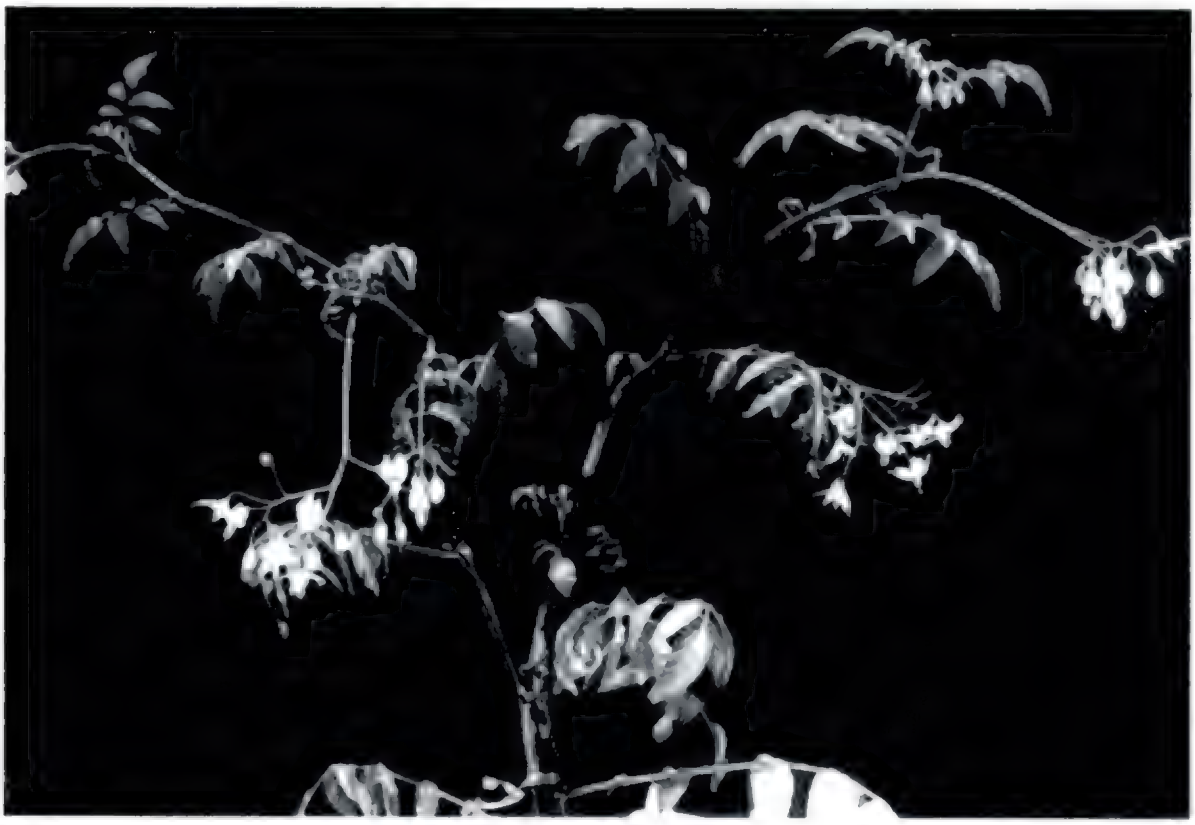


Figure 430. *Solanum yungasense*-3x, in its natural habitat, vicinity of the Village of San Juan del Oro, 1500 m alt., Sandia, Puno.

APPENDIX I

Preliminary results on the chloroplast ctDNA research of the Peruvian wild potatoes according to D. K. Hosaka and C. M. Ochoa.

OCH Collections	CtDNA Type	Peru Dept.
acaule		
13872	C	Junin
14389	C	Ayacucho
15678	C	Cusco
15727	C	Ancash
15730	C	Ancash
acroglossum		
11297	W	Pasco
albicans		
12088	C	Ancash
OCHS 16022	C	Cajamarca
OCHS 16033	C	Cajamarca
OCHS 16033	C	Cajamarca
ambosinum		
11298	C	Pasco

OCH Collections	CtDNA Type	Peru Dept.
ancophilum		
12086	C	Ancash
ancoripae		
13662	C	Apurimac
augustii		
Espejo 008	W	Ancash
bukasovii		
9928	C	Ayacucho
11292	C	Junin
11337	C	Junin
11841	C	Junin
13194	C	Ayacucho
13672	C	Apurimac
13714	C	Cusco
13747	C	Apurimac
15076	C	Puno
13858	C1	Pasco
15202	C1	Pasco
bukasovii f. *multidissectum*		
13524*	S	Puno
13524*	S	Puno
13581	C	Cusco
chancayense		
11250	W4	Lima
chomatophilum		
OCHS 16017	W	Cajamarca
OCHS 16072	W	Cajamarca
coelestispetalum		
13687	C	Cusco

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* ecotype of white flowers

OCH Collections	CtDNA Type	Peru Dept.
gracilifrons		
13117	C	Huancavelica
huancabambense		
11619	W	Piura
huarochiriense		
11335	C	Lima
hypacrarthrum		
11692	W	Ancash
immite		
11689	W	Ancash
13346	W	La Libertad
incahuasinum		
11613	W4	Lambayeque
incasicum		
13631	C	Cusco
laxissimum		
11855	W	Junin
13640	W	Cusco
leptophyes		
13743	C	Apurimac
marinasense		
14384	C	Apurimac
medians-2x		
11249	W	Lima
11882	W	Lima
megistacrolobum		
15619	C	Puno

OCH Collections	CtDNA Type	Peru Dept.
multiinterruptum		
12052	C	Ancash
14719	W	Lima
orophilum		
12077	C	Ancash
raphanifolium		
14380	C	Cusco
rhombilanceolatum		
13111	A	Junin
13112	C	Junin
scabrifolium		
Och S 60	C	Huanuco
sogarandinum		
113324	W	La Libertad
tacnaense		
11611	C	Moquegua
wittmackii		
13267	W	Lima
14674	W5	Lima

Note: Intra-specific ctDNA variation is a common phenomenon. Particularly, *S. rhombilanceolatum* has interestingly A and C type ctDNA. This implies that this species is the most probable ancestral species of *S. stenotomum*. To confirm or not, further research is absolutely necessary.

APPENDIX II

Sources of resistance to virus in wild potatoes from Peru and Boliva

by Luis F. Salazar, C.M. Ochoa and A. Salas

Using the wild potato collections that are incorporated in the CIP germplasm bank, some laboratory and green house investigations were conducted to determine the sources of resistance against different types of viruses. In this summary, each collection is identified by its CIP number as well as its original collector number. Further information, including the complete passport data for each collection, is cited in Ochoa's (1990) Bolivian potato book and in the present work on wild species of Peruvian potatoes.

This research has been conducted under the supervision of Dr. Luis Salazar, Head of Pathology Department at CIP.

The different types of virus considered in these studies:

APLV = Andean potato leaf virus
APMV = Andean potato mottle virus
PLRV = Potato leafroll virus
PSTVd = Potato spindle tuber viroid
PVS = Potato virus S
PVT = Potato virus T
PVXc = Potato virus X, common strain
PVX-$_{HB}$ = PVX, strain-$_{HB}$
PVY$^{\circ}$ = Potato virus Y, strain$^{\circ}$

The types of resistance observed were: R = Resistance. I = Inmunity or with extreme resistance. H = Hypersensitivily. S = Susceptibility.

CIP No.	Collector No.	APLV	APMV	PLRV	PSTVd	PVS	PVT	PVXc	PVX-$_{HB}$	PVY^{o}
S. acaule (2n=24, EBN=2) de Perú										
CIP 761125	OCH 7990		R	R	S		S	S	S	
CIP 761129	OCH 8611	S	S	S	S	S	I, S	S		S
CIP 761130	OCH 8612	S	S	R	R	S	S	R, S	S	S
CIP 761024	OCH 11603	S	S	S	R	S	S	S		S
CIP 761435	OCH 12069pp			S	S		R	S		S
CIP 761438	OCH 12073				R, S					
CIP 761057	OCH 12092			S	S		I, R	S		S
CIP 761464	OCH13005				S		R	S		S
CIP 761822	OCH 13817	S	S	S	S	S		S		R, S
CIP 761823	OCH 13818	S	S	R	S	S		R		S
CIP 761825	OCH13820	S	S		S	S		S		S
CIP 761826	OCH 13821	S	S		S	R		S		S
CIP 761828	OCH 13823	S	R	I	S	S		S	R	S
CIP 761829	OCH 13824	S	S	I	S	S		S		S
CIP 761953	OCH 14274	S	R	R	R	S		S	S	S
CIP 761955	OCH 14276	S	S	R	R	S		S	S	S
CIP 761958	OCH 14279	S	S	R	R	S		S	S	S
CIP 761961	OCH 14282	S	R	R	R	S		S	S	S
CIP 761965	OCH 14286	S	S	S	R	S		S	S	S
CIP 761971	OCH 14294	S	S	R	R	S		R	S	S
CIP 761972	OCH 14295	S	S	R	R	S		R	S	S
CIP 761978	OCH 14304	S	S	R	R	S		S	S	S
CIP 761979	OCH 14305	S	S	R	R	S		S	S	S
CIP 761987	OCH 14315	S	S	R	R	S		S	S	S
CIP 762030	OCH 14389					R				
CIP 762031	OCH 14390	S	S	R	R	S		S	S	S
CIP 762032	OCH 14391	R, S	S	R	R	S		S	R, S	S
CIP 762033	OCH 14392	S	S	R	R					
CIP 762035	OCH 14394	S	S	R	R	S		S	S	S
CIP 762043	OCH 14402	S		S	R	R				
CIP 762044	OCH 14403	R, S	S	R	R	R		S	S	S
CIP 761139	OCHS 9796			S	S		I, S	S		S
CIP 761150	OCHS 10112	S	S	R	R, S	S	I, S	S	S	S
CIP 761330	OCHS 11889				S		S	I, R		S
CIP 761331	OCHS 11890					S		R	R	
S. acaule (2n=24, EBN=2) de Bolivia										
CIP 761027	OCHS 11818	S	R	S	S	S		R	S	S
CIP 761286	OCHS 11823	S	S	R	R	S		R	S	S
CIP 761287	OCHS 11824	S	R	S	S	S	S	S	S	S
CIP 761288	OCHS 11825	S	S	R	R	S		R	S	S
CIP 761289	OCHS 11826	S	S	R	R	S		R, S	S	S
CIP 761290	OCHS 11829	S	R	S	R, S	S		H, S	S	S
CIP 761291	OCHS 11830	S	S	S	R	S		H, S	S	S
CIP 761292	OCHS 11831	S	S	R	R	S		S	S	R, S
CIP 761293	OCHS 11832	S	S	S	R, S	S		S	S	S
CIP 761294	OCHS 11833	S	R	S	S	S		R	S	S
CIP 761330	OCHS 11889				S		S	I, R		S
CIP 761331	OCHS 11890				S		R	R		

CIP No.	Collector No.	APLV	APMV	PLRV	PSTVd	PVS	PVT	PVXc	PVX-$_{HB}$	PVY^{o}
CIP 761345	OCHS 11910	S	R	S	R	S		S	S	S
CIP 761346	OCHS 11910A				S		I, S	S		S
CIP 761347	OCHS 11912	S	S	S	S	S		R		S
CIP 761379	OCH 11983	S	S		S	S	I	I, R		S
CIP 761380	OCH 11984	S	S		S	S	S	I, R		S
CIP 761386	OCH 11990				S		R	R, G		S
S. acaule f. *incuyo* (2n=48, EBN=2) de Perú										
CIP 761946	OCH 14267	S	S	R	R, S	S		R, S	R	R
CIP 762038	OCH 14397	S	S	R	R, S	R		S	S	R
CIP 762039	OCH 14398	S	S	R	R	S		S	S	S
S. alandiae (2n=24, EBN=2) de Bolivia										
CIP 761392	OCH 12011			R	R	R		S	S	R
CIP 761394	OCH 12013			S		S			H, S	S
CIP 761395	OCH 12016			R, S	R	R		S	S	R
S. albicans (2n=72, EBN=4) de Perú										
CIP 761433	OCH 12067	S	S		R	S	S	S		
CIP 761444	OCH 12081A				S	S	R, S		S	
CIP 761453	OCH 12090			S			R, S			S
CIP 761456	OCH 12094				R, S					
CIP 761472	OCH 13014			S, R	S	S	S, R	S	S	R
CIP 762578	OCHS 16022			R	S	S		S	R	S
CIP 762579	OCHS 16023			R	R	S		S	S	S
S. ambosinum (2n=24, EBN=2) de Perú										
CIP 762070	OCH 14603			R	S	R		S	S	S
CIP 761194	OCHS 11298			R	R	R		S	R, S	S
S. ancophilum (2n=24, EBN=2) de Perú										
CIP 761448	OCH 12086	S		S	S	S		S	S	R
CIP 761459	OCH 12099	S		S	S		S	S		R
S. × *blanco-galdosii* (2n=24, EBN=2) de Perú										
CIP 761466	OCH 13009	S	S	S	R	S	S	H		S
S. boliviense (2n=24, EBN=2) de Bolivia										
CIP 761353	OCH 11929	S	R	S	S	S		H, I	S	S
CIP 762519	OCH 11933	S	R, S	S	S	S		S	S	S
CIP 761356	OCH 11938	S	R	S	S	S		H, I	S	S
CIP 761364	OCH 11954	S	S	S	R, S	S		S	S	S
S. brevicaule (2n=24, EBN=2) de Bolivia										
CIP 761074	OCH 11934	S	S	S	S	S		H	S	S

CIP No.	Collector No.	APLV	APMV	PLRV	PSTVd	PVS	PVT	PVXc	PVX-$_{HB}$	PVY^{o}
S. buesii (2n=24, EBN=2) de Perú										
CIP 761690	OCH 13637			S	R	R		S	S	S
S. bukasovii (2n=24, EBN=2) de Perú										
CIP 761132	OCH 8693	S	S	S	S	S	R	S		S
CIP 761191	OCH 11292	S	S	S	R	S	S	S		S
CIP 761219	OCH 11330	S	H	R	S	S	S	S		S
CIP 761817	OCH 13813	S	R, S	S	S	S		S		S
CIP 761843	OCH 13854	S	S	R	S	S		S		S
CIP 761847	OCH 13858	S	R, S	S	S	S		R, S		S
CIP 762011	OCH 14359	S	S	S	R	R		S	S	S
CIP 762023	OCH 14383				R					
CIP 762040	OCH 14399				R					
CIP 761193	OCHS 11295	S	S	S	S	S	R	S		S
CIP 761299	OCHS 11844	S	S	S	S	S	R	S		S
CIP 761311	OCHS 11864A	S	R			S	R	H		S
S. bukasovii f. *multidissectum* (2n=24, EBN=2) de Perú										
CIP 761654	OCH 13586	H	S			S	S	S		S
S. cajamarquense (2n=24, EBN=2) de Perú										
CIP 762616	OCHS 16118			R	S	S		S	S	S
S. candolleanum (2n=24, EBN=2) de Bolivia										
CIP 761282	OCHS 11814	S	S	S	R	S		H, I	S	S
CIP 761337	OCHS 11896	S	R			S	R	R		S
CIP 761338	OCHS 11897	S	S	R	S			S		S
CIP 761041	OCHS 11913		S			R			H, S	S
S. candolleanum var. *sihuampampinum* (2n=24, EBN=2) de Bolivia										
CIP 761295	OCHS 11835	S	S	S	R	S		S	S	S
S. chiquidenum (2n=24, EBN=2) de Perú										
CIP 761069	OCHS 11059				R	R		S	S	S
CIP 762052	OCHS 14482			R	R	R		S	S	R
CIP 762056	OCHS 14487									R5
S. chomatophilum (2n=24, EBN=2) de Perú										
CIP 761051	OCH 10728	S	S	S	S	S	R	S		S
CIP 761173	OCH 11061	R, S	S	S	R	S	R	S		S
CIP 761077	OCH 13196	S	R, S	S	R	R		S	R	S
CIP 761541	OCH 13199	R,S	S	S	R	R		S		S
CIP 761582	OCH 13325			S	S	S, R		S	R, S	R
CIP 762570	OCHS 12563			R	S	R		S	S	
CIP 762575	OCHS 12570			R	S	R		S	S	
CIP 762053	OCHS 14484			R	R	S		S	S	R
CIP 762054	OCHS 14485			R	R	R		S	S	R
CIP 762055	OCHS14486			R	R	R		S	S	

CIP No.	Collector No.	APLV	APMV	PLRV	PSTVd	PVS	PVT	PVXc	PVX-$_{HB}$	PVY^{o}
S. circaeifolium (2n=24, EBN=2) de Bolivia										
CIP 761279	OCHS 11796	S				S	S	S		R
CIP 761344	OCHS 11909	S	H	S		S	R	H		S
S. circaeifolium var. *capsicibaccatum* (2n=24, EBN=2) de Bolivia										
CIP 761030	OCHS 11915	S	S	S	R, S	S		S	S	S
S. coelestispetalum (2n=24, EBN=2) de Perú										
CIP 761715	OCH 13674	S	R	R	R	S	R	S		S
CIP 761809	OCH 13801	S	S	R	S	S		S	S	S
CIP 762005	OCH 14351			R	S	R		S	S	S
S. huancabambense (2n=24, EBN=2) de Perú										
CIP 761240	OCH 11627	S	S	R	S			S		S
CIP 762123	OCHS 14815			S	S	S		S	S	R
S. immite (2n=24, EBN=2) de Perú										
CIP 761040	OCH 11689			S	R	R		S	S	S
S. incahuasinum (2n=24, EBN=1) de Perú										
CIP 761234	OCHS 11613	S	H			S	S	S		H
S. irosinum (2n=24, EBN=2) de Perú										
CIP 762257	OCHS 15210				R	R		S, R	S	R
S. lignicaule (2n=24, EBN=1) de Perú										
CIP 761212	OCH 11317	S	S	R, I	S			S		S
CIP 761236	OCH 11617			S	S	S	S	S		S
S. megistacrolobum (2n=24, EBN=2) de Perú										
CIP 761109	OCH 7609	S	R, S	S	R, S	S	S	H, S		H, S
S. megistacrolobum (2n=24, EBN=2) de Bolivia										
CIP 761381	OCH 11985	S	S	R	S	S		I, H	S	S
CIP 761383	OCH 11987	S	S	S	S	S	R, I	S		S
S. marinasense (2n=24, EBN=2) de Perú										
CIP 762024	OCH 14384				R					
S. multiinterruptum (2n=24, EBN=2) de Perú										
CIP 761267	OCH 11705	S	S		S, H			S		S
CIP 761420	OCHS 12053	S	S	S	S			S		S

CIP No.	Collector No.	APLV	APMV	PLRV	PSTVd	PVS	PVT	PVXc	PVX-$_{HB}$	PVY^{o}
S. oplocense (2n=72, EBN=4) de Bolivia										
CIP 761371	OCH 11970	S	S	S	S	S		R		S
S. orophilum (2n=24, EBN=2) de Perú										
CIP 761440	OCH 12077			S	S	R		S	S	S
CIP 761478	OCH 13023			S	S	R			S	S
S. raphanifolium (2n=24, EBN=2) de Perú										
CIP 761673	OCH 13611	S	S	R	S	S	S	S		S
CIP 761692	OCH 13641	R						S	H	
CIP 761013	OCH 13741	R, S	S	R	S	R		S		S
S. sucrense (2n=48, EBN=4) de Bolivia										
CIP 761351	OCH 11926	S	R	S	S	S	S	R	I, H	H
S. sogarandinum (2n=24, EBN=2) de Perú										
CIP761465	OCH 13006	S	S	S	S	S	S	S		
CIP 761586	OCH 13336	S	R		R	R	S	S		
S. sparsipilum (2n=24, EBN=2) de Bolivia										
CIP 761357	OCH 11939	R	R	S	S	S	R	R		H
CIP 761010	OCH 12030				S	R, S		S	R	R
S. wittmackii (2n=24, EBN=1) de Perú										
CIP 761167	OCHS 11029	S	R			S	R, S	S		S
CIP 761205	OCHS 11309	S	R			S	R	H		S

ACRONYMS OF THE CONSULTED HERBARIA

B	Berlin, Germany: Botanischer Garten und Botanisches Museum Berlin-Dahlem
BH	Ithaca, New York, USA: L.H. Bailey Hortorium, Cornell University
BM	London, Great Britain: Herbarium, British Museum (Natural History)
BREM	Bremen, Germany: Übersee-Museum
CA	Cochabamba, Bolivia: Herbarium Cardenasianum, in Herbario Facultad de Ciencias Agrícolas, Universidad de Cochabamba
CIP	Lima, Peru: International Potato Center Herbarium
CPC	Edinburgh, Great Britain: Commonwealth Potato Collection, Scottish Crop Research Institute
CUZ	Cuzco, Peru: Herbario Vargas, Departamento de Botánica, Universidad Nacional San Antonio Abad
E	Edinburgh, Great Britain: The Herbarium, Royal Botanic Garden
F	Chicago, Illinois, USA: John G. Searle Herbarium, Field Museum of Natural History
G	Geneva, Switzerland: Conservatoire et Jardin Botaniques
GH	Cambridge, Massachusetts, USA: The Gray Herbarium of Harvard University
GL	Glasgow, Great Britain: Department of Botany, University of Glasgow

GOET	Göttingen, Germany: Systematisch-Geobotanisches Institut, Universität Göttingen
HBG	Hamburg, Germany: Staatsinstitut für Allgemeine Botanik
HUT	Trujillo, Peru: Herbarium Truxillensi, Universidad Nacional de Trujillo
K	Kew, Great Britain: The Herbarium, Royal Botanic Gardens
L	Leiden, Netherlands: Rijksherbarium
LD	Lund, Sweden: Botanical Museum and Herbarium
LE	Leningrad, USSR: Herbarium of the Department of Higher Plants, V.L. Komarov Botanical Institute of the Academy of Sciences of the U.S.S.R.
LIL	Tucumán, Argentina: Fundación e Instituto Miguel Lillo, San Miguel de Tucumán
LL	Renner, Texas, USA: Lundell Herbarium, Texas Research Foundation
M	München, Germany: Botanische Staatssammlung
MA	Madrid, Spain: Herbario Instituto Botánico Cavanilles, Jardín Botánico
MAX	Cologne-Vogelsang, Germany: Max-Planck-Institut
MO	Saint Louis, Missouri, USA: Herbarium of Missouri Botanical Garden
MOL	Lima, Peru: Herbarium of the Universidad Nacional Agraria, La Molina
NA	Washington, D.C., USA: Herbarium of the United States National Arboretum
NY	New York, USA: Herbarium of the The New York Botanical Garden, Bronx
O	Oslo, Norway: Botanical Museum
OCH	Lima, Peru: Private herbarium of C. Ochoa
OXF	Oxford, Great Britain: Fielding-Druce Herbarium, Department of Botany, University of Oxford
P	Paris, France: Muséum National d'Histoire Naturelle, Laboratoire de Phanerogamie
PH	Philadelphia, Pennsylvania, USA: Department of Botany, Academy of Natural Sciences
S	Stockholm, Sweden: Herbarium, Swedish Museum of Natural History (Naturhistoriska Riksmuseet)
SI	San Isidro, Buenos Aires, Argentina.: Instituto de Botánica Darwinion

U	Utrecht, Netherlands: Herbarium of the Institute for Systematic Botany
UC	Berkeley, California, USA: Herbarium of the University of California, Department of Botany, University of California
UNTC	Cajamarca, Peru: Herbarium of the Universidad Nacional Técnica de Cajamarca,
US	Washington, D.C., USA: National Museum Herbarium Department of Botany, Smithsonian Institution
USM	Lima, Peru: Herbario San Marcos, Museo de Historia Natural, Universidad Nacional Mayor de San Marcos
W	Wien, Austria: Naturhistorisches Museum, Botanische Abteilung
WIR	Leningrad, USSR: The All-Union Institute of Plant Industry
WIS	Madison, Wisconsin, USA: Herbarium, Department of Botany, University of Wisconsin
Z	Zürich, Switzerland: Botanischer Garten und Institut für Systematische Botanik der Universitat Zürich

Exsiccatae

Numerical list of the Wild Taxa

1 *S. acaule*
1a f. *incuyo*
2 *S. albicans*
3 *S. ayacuchense*
4 *S. buesii*
5 *S. burkartii*
6 *S. chomatophilum*
6a var. *subnivale*
6b f. *sausianense*
7 *S. contumazaense*
8 *S. irosinum*
8a f. *tarrosum*
9 *S. jaenense*
10 *S. laxissimum*
11 *S. limbaniense*
12 *S. nemorosum*
13 *S. neovargasii*
14 *S. nubicola*
15 *S. pillahuatense*
16 *S. rhombilanceolatum*
17 *S. salasianum*
18 *S. santolallae*
19 *S. urubambae*
19a f. *chakchabambense*
19b f. *velutinum*
20 *S. anamatophilum*
21 *S.* × *blanco-galdosii*
22 *S. peloquinianum*
23 *S. ingaefolia*
24 *S. jalcae*
24a var. *pubescens*
25 *S. raquialatum*
26 *S. lignicaule*
27 *S. dolichocremastrum*
28 *S. hastiforme*
29 *S. megistacrolobum*
29a var. *toralapanum*
29b f. *purpureum*
30 *S. raphanifolium*
31 *S. sogarandinum*
32 *S. olmosense*
33 *S. acroglossum*
34 *S. ariduphilum*
35 *S. cantense*
36 *S. chiquidenum*
36a var. *gracile*
36b var. *robustum*
36c f. *amazonense*
37 *S. humectophilum*
38 *S. hypacrarthrum*
39 *S. paucissectum*
40 *S. piurae*
41 *S. yamobambense*
42 *S. guzmanguense*

43	*S. simplicissimum*
44	*S. acroscopicum*
45	*S. amayanum*
46	*S. ambosinum*
47	*S. ancophilum*
48	*S. ancoripae*
49	*S.* × *arahuayum*
50	*S. augustii*
51	*S. aymaraesense*
52	*S. bill-hookeri*
53	*S. bukasovii*
53a	f. *multidissectum*
54	*S. cajamarquense*
55	*S. candolleanum*
56	*S. chancayense*
57	*S. chillonanum*
58	*S. coelestispetalum*
59	*S. gracilifrons*
60	*S. huancabambense*
61	*S. huancavelicae*
62	*S. huarochiriense*
63	*S. immite*
63a	var. *vernale*
64	*S. incahuasinum*
65	*S. incasicum*
66	*S. leptophyes*
67	*S. longiusculus*
68	*S. lopez-camarenae*
69	*S. marinasense*
70	*S. medians*
70a	var. *autumnale*
71	*S. mochiquense*
72	*S. multiinterruptum*
72a	var. *machaytambinum*
72b	f. *albiflorum*
73	*S.* × *neoweberbaueri*
74	*S. orophilum*
75	*S. pampasense*
76	*S. puchupuchense*
77	*S. sandemanii*
78	*S. sarasarae*
79	*S. sawyerii*
80	*S. saxatilis*
81	*S. scabrifolium*
82	*S. sparsipilum*
83	*S. tacnaense*
83a	f. *decurrentialatum*
84	*S. tapojense*
85	*S. tarapatanum*
86	*S. taulisense*
87	*S. trinitense*
88	*S. velardei*
89	*S. wittmackii*
90	*S. yungasense*

EXSICCATAE OF THE WILD TAXA

The numbers before the parentheses correspond to collector's numbers; the numbers in parentheses belong to the cited species in the numerical list of taxa. In total, I have examined more than four thousand collections.

Abbott, J.,
    s.n. (53).
Aguilar, J.,
    s.n. (1).
Andre, E.,
    4114 (89).
Angulo, N.,
    1213 (71).

Arenas Ponce, G.,
144 (44).

Asplund, E., 12818 (10).

Balls, E.K. and . Hawkes,
6620, 6667, 6668 (53); 6744(82); 6770, 6778 (53a); 6931 (53); 7007 (75).

Barranca, S.
208 pp. (70); 208 pp. (89).

Bauman, D.,
s.n. (35); s.n., s.n. (53); s.n. (53a); s.n., s.n.(62); s.n., s.n. (70); s.n. (72).

Baur, E. (Sortiment),
1887 (69).

Bingham, H.,
556, 722 (4).

Blanco, O.,
s.n., s.n., s.n., s.n. (19).

Blood, H.L. and L. Tramalling,
34 (1); 175 (26); s.n. (58); s.n. (66).

Cabanillas Soriano, J.,
357 (24).

Capurro,
s.n. (36).

Cárdenas, M.,
3506 (30).

Cárdenas, M. and H. Gandarillas,
3500, 3501 (30).

Carrillo and H. Ross,
782 (53).

Cerrate, E.,
3, 188, 342 (72); 344 (1); 345, 624, 719 (72); 1170 (53); 1259 (1); 1353 (72); 1558 (6); 2042 (62); 2742 (89); 3738 (20); 3760 (46).

Cerrate, E., M. Chacón and G. Vilcapoma,
257 (70a); 260 (63).

Cerrate, E. and O. Tovar,
1802, 1884 (62).

Chrosttowski, M.S.,
s.n. (71),

Cook, O.F. and G.B. Gilbert,
180, 181, 182a (1); 185, 199 (30).

Correll, D.S. and E.E. Smith,
P124 (1); P148 (70a); P153 (53); P154, P155 (1); P157, P162, P168(53);

P178, P179, P180, P181, P191, P192 (1); P193, P193s2, P194, P194s1, P194s2 (29); P196 (53); P196-1 (53a); P196-2, P197, P198, P199, P200 (53); P201 (53a); P213 (29); P214 (1); P215, P215-2 (53); P218, P218pp2, P219, P220, P221 (30); P222 (29a); P223, P223-2 (53); P232 (85); P258 (69); P258s1,P258s2 (69); P259, P259s1, P259s2 (58); P260 (82); P261 (19b); P291 (72); P722, P724-1, P724-2 (53);P725 (1); P726, P728, P731, P733, P749, P750 (53); P751 (1); P752, P788 (53); P827 (60); P836 (71); P840 (6); P848 (54); P854, P854s1, P854s2, P855 (36); P862 (6); P863 (2); P866, P867 (24a); P868 (6); P877, P919 (36); P930 (28); P941 (24); P942 (27); P947 (36); P949 (70a); P950 (72); P954, P957, P965 (47); P966pp1 (2); P966pp2 (1); P967, P970 (27); P971 (74); P972, P973 (27); P974, P976(72).

Correll, D.S., E.E. Smith and R. Ferreyra,
P282, P283, P285 (70a); P290s1, P290s2 (35); P293s2, P295, P296 (72); P297 (53); P298 (1).

Correll, D.S., E.E. Smith and C. Vargas C.,
P224 (30); P225, P225s1 (69); P225s2 (53); P227 (26); P228 (30); P229 (69); P230, P230s1 (30); P231 (82); P232 (85); P233, P234, P235, P237 (30); P237pp (29);P237pp (30); P238, P238-2 (53); P239 (82); P240, P240s1, P240s2, P241pp (30); P241pp(53).

Davis, W., E. Franquemont, C. Franquemont, S. King and C. Sparing,
1353 (1); 1798 (69).

De la Puente, Fermín,
s.n. (72).

Delgado, M.A.,
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Diers, L.,
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Dillon, M., U. Molau and P. Matekoitis,
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Dombey, J.,
s.n. (27).

Espejo Ruiz, J.,
3, 4, 5 (72); 7 (50); 8pp (6); 8pp (50); 9 (6); 10 (62); s.n. (50); s.n. (72).

Esposto, N.,
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Ferreyra, R.,
1768 (33); 1942, 2389 (10); 3413 (38); 5226 (53); 5402 (70); 5502, 5515 (53); 6264 (89); 6521 (53a); 6531 (1); 6915, 6918, 6932 (70a); 6961 (70);

6985 (53); 7056 (70a); 7425 (6); 8022 (73); 8609 (71); 8718 (63); 8718a (56); 8835 (70); 8940, 8950 (53); 9000 (70a); 12157 (2); 12948 (70a); 13275(6).

Ferreyra, R., E.E. Smith and D.S. Correll,
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Ferreyra, R. and E. Cerrate,
12131 (72).

Ferreyra, R. and P. Hjerting,
14130, 14144 (56); 14148 (89).

Gade, D.,
s.n. (82).

Gentry, A. and D. Smith,
36121 (70).

Gómez, L. and A. Tapia,
s.n. (83).

Goodspeed, T.H.,
33116 (70a).

Goodspeed, T.H., H.E. Stork and O.B. Horton,
11525 (70a).

Guenther, E. and O. Buchtien,
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Hawkes, J.G.,
2477 (82); 2482, s.n. (26).

Hawkes, J.G., A.H. van Harten and J. Landeo,
5407 (53); 5488(1).

Hawkes, J.G., J.P. Hjerting, P.J. Cribb and Z. Huamán,
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Herrera, F.L.,
2343 (30); s.n. (69).

Hinkley, F.E.,
46 (77).

Hjerting, J.P.,
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Hjerting, J.P., P.J. Cribb and Z. Huamán,
5083, 5086, 5095, 5097 (30); 5107 (69); 5111 (30); 5113 (26); 5141 (30); 5146 (69); 5147, 5152 (82); 5211, 5220, 5221, 5222, 5225(53).

Hodge, W.H.
6217 (46); 6223 (53).

Huamán, Z.,
47 (53); 73 (70); 235 (56); 237, 237A (63); 238 (70); 291, 292 (70a); 307, 308, 309 (38); 357 (70a); 485, 647 (6); 736 (29); 937 (23); 964 (40); 966 (60); 974 (39); 975, 976 (40).

Huamán, Z., F. de la Puente, J. Bryan and H. Ross,
293-A (89); 294A, 306 (70).

Huamán, Z., J. Bryan, F. de la Puente and H. Ross,
293B, 294B, 310, 311 (72).

Huamán, Z. and D. Bryan,
302 (35); 304 (53).

Hutchison, P.C. and J.K. Wright,
4430 (32).

Hutchison, P.C.,
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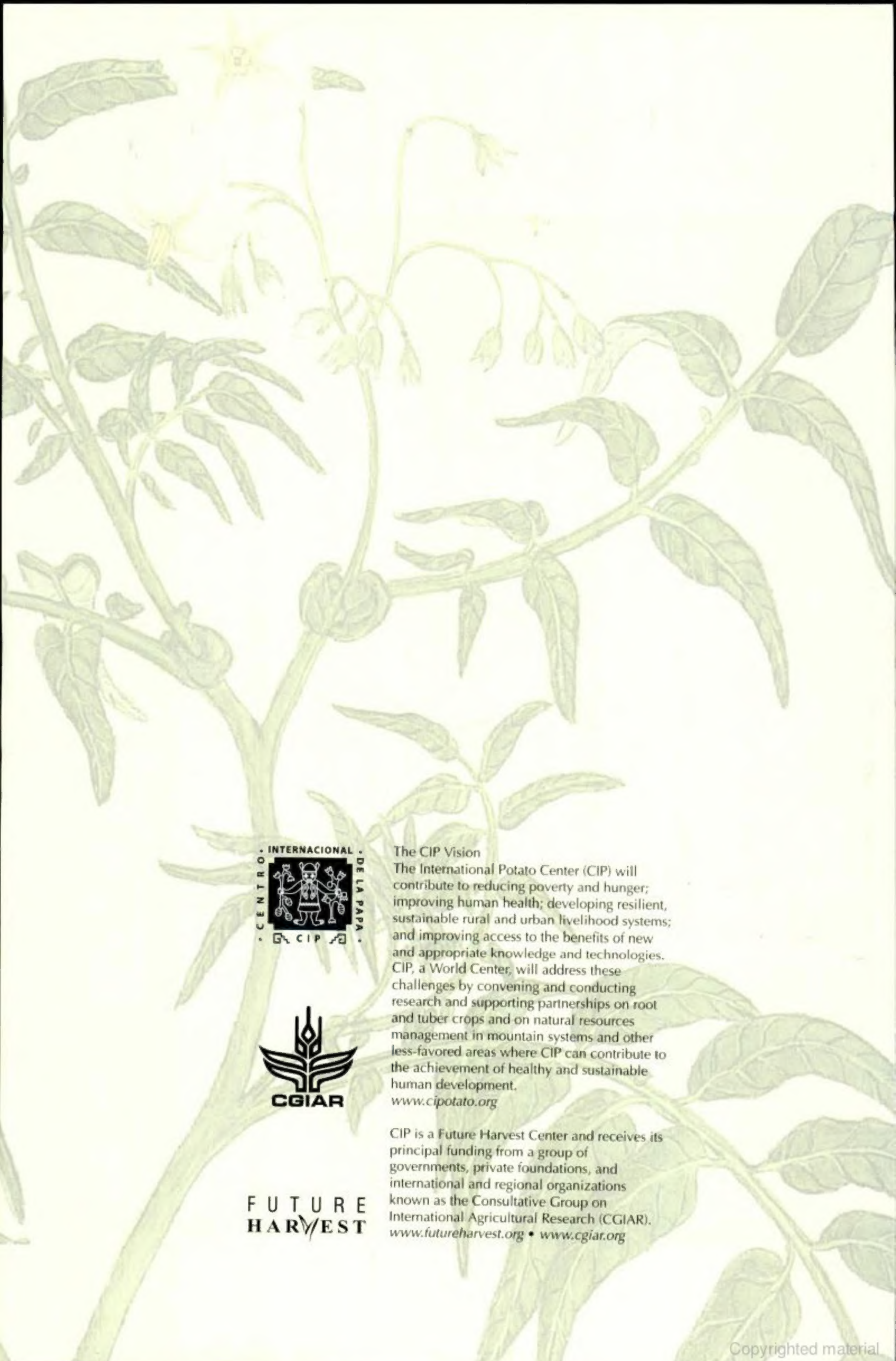
About the Translator

Don Ugent and Carlos Ochoa have been collaborating on the study of the wild and cultivated potato species for over 40 years. The two met originally in December of 1962 in Lima, Peru. Shortly afterwards, the two scientists (who by that time had become close friends) began a period of consultation with one another on problems of mutual scientific interest. Eventually, the ties between these two investigators led to the publication in Spanish of a book on the Bolivian potatoes by Ochoa, and its translation into the English language by Ugent. With regard to these cooperative efforts, the late William G. D'Arcy, who penned the preface to the English edition of the 1990 Bolivian work, remarked, "Most texts tend to lose something in translation from one language to another; however, for this book it is more a case of two professional potato taxonomists collaborating to create a text based on the work of one of them. Ugent brings seasoned and expert skills to the translation task." Today, these words would appear to be no less true with regard to the current work.

Professionally, Ugent is an ethnobotanist and an emeritus professor of plant biology at Southern Illinois University, Carbondale. During his teaching career, he held a number of other related appointments at the university, including professor in the SIU Center for Archaeological Investigations, adjunct professor of botany for the Southern Illinois University Museum, and curator of the SIU Herbarium. He is known internationally for his work as editor-in-chief for the journal, Economic Botany, and for his development of the website, Ethnobotanical Leaflets. Dr. Ugent has traveled widely through the American tropics, including expeditions to Mexico, Belize, Jamaica, St. Thomas, Venezuela, Ecuador, Peru and Bolivia. He has authored numerous scientific articles and several book chapters on the food plants of the Americas, including papers dealing with the archaeological remains, botanical origins and domestication of indigenous crop plants. Along with his students, he has conducted research on the edible and medicinal plants of native marketplaces in Mexico, the West Indies and South America.



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